







# **TOWN OF MOUNT WASHINGTON**

DRAFT HAZARD MITIGATION AND CLIMATE ADAPTATION PLAN

Last worked on - October 20, 2022

#### **ACKNOWLEDGEMENTS**

The development of this *Mount Washington Hazard Mitigation and Climate Adaptation Plan* has been made possible with financial support from the Hazard Mitigation Grant Program, issued by the Federal Emergency Management Agency and administered by the Massachusetts Emergency Management Agency (MEMA). Additional public participation, climate adaptation and preparedness has been made possible through Municipal Vulnerability Preparedness (MVP) planning grant provided by Massachusetts Executive Office of Energy & Environmental Affairs (EOEEA). The Town would like to thank the unerring support and guidance provided by MEMA's hazard mitigation staff and EOEEA's MVP staff throughout this planning process.

The Town of Mount Washington would like to thank the members of the Mount Washington Hazard Mitigation & Municipal Vulnerability Preparedness Committee, who served as the advisory committee for this planning effort.

The Berkshire Regional Planning Commission provided technical assistance to the Town and the Planning Committee throughout the planning and approval processes.

# **PUBLIC COMMENT**

To provide public comment on this plan, please email Courteny Morehouse, Berkshire Regional Planning at cmorehouse@berkshireplanning.org or call 413-442-1521 x26

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# **CHAPTER 1: INTRODUCTION**

#### Purpose

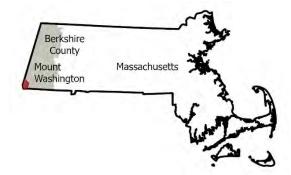
The purpose of hazard mitigation planning is to reduce or eliminate the need to respond to hazardous conditions that threaten human life and property. As noted in the 2018 *Massachusetts State Hazard Mitigation and Climate Adaptation Plan* (SHMCAP, 2018), Natural Hazards are natural events that threaten lives, property, and other assets. Often, natural hazards can be predicted and tend to occur repeatedly in the same geographical locations because they are related to weather patterns or physical characteristics of an area. Hazard Mitigation is a term that describes an action taken to reduce the harm that natural disasters have on people and property — it is the up-front work to mitigate or reduce the impacts of a disaster when it strikes. The mitigation action is pro-active, rather than reactive, and is an action taken to solve a problem on a permanent, long-term basis. Climate Adaptation is an adjustment in natural or human systems that respond to actual or expected climatic stimuli or their effects (SHMCAP, 2018). In man-made systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment.

Resilience is the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event or a changing climate in a timely and efficient manner - the ability to "bounce back" where mitigation may not work.

The Town of Mount Washington Hazard Mitigation and Climate Adaptation Plan (HMCAP) was prepared in order to meet the requirements of the Code of Federal Regulations, Title 44 CFR § 201.6 pertaining to local hazard mitigation plans. Title 44 CFR § 201.6(a)(1) states that "a local government must have a mitigation plan approved pursuant to this section in order to receive hazard mitigation project grants. A local government must have a mitigation plan approved pursuant to this section in order to apply for and receive mitigation project grants under all other mitigation grant programs." The Town's eligibility for FEMA's hazard mitigation grants is crucial.

This plan was also prepared to meet requirements of the Massachusetts Executive Office of Energy and Environmental Affair's (EEA) Municipal Vulnerability Preparedness (MVP) Planning Grant, which enabled Mount Washington to complete this plan, and to integrate local effects of climate change into their hazard mitigation action plan. By completing the Community Resilience Building (CRB) process, Mount Washington will be an MVP community eligible for MVP Action Grants to adapt to the impacts of climate change on the community.

Figure 1.1. Location of Mt. Washington within Massachusetts



The defined mission for the Town of Mount Washington

Hazard Mitigation and Climate Adaptation Plan is to "Reduce loss and damage to life, property, infrastructure and the natural resources of the Town due to disaster and climate change by identifying and developing cost-effective actions to mitigate damages and loss." In accordance with Title 44 CFR § 201.6 the local mitigation plan is the representation of the Town's commitment to reduce risks from

<sup>&</sup>lt;sup>1</sup> SHMCAP, 2018. EOEEA & MEMA, Boston, MA.

natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards. Additionally, the HMP is meant to serve as the basis for the Commonwealth of Massachusetts to provide technical assistance and to prioritize project funding.

## Background

The Town of Mount Washington covers an area of 22.39 square miles. The town's population is 148², giving a density of approximately 7 people per square mile. There are 143 households, resulting in a household size of approximately 1.03 people per household (US Census Bureau, 2020). According to MassGIS Landuse data, the predominant land uses in town are forest (93%), open water and wetland (3%), residential (1%), and agricultural (1%) (MassGIS, 2016). The Town has an agreement with the South Berkshire Regional School District to send its students to the regional schools. Kindergarten and first grade students attend the South Egremont School, second through sixth grade students attend Undermountain School in Sheffield, and seventh through twelfth grade students attend Mount Everett Regional High School in Sheffield.

The Town of Mount Washington is the most southwestern municipality in Massachusetts, bordered to the west by both Columbia County and Dutchess County, New York and to the south by Litchfield County, Connecticut. Its northern border is the Town of Egremont and to the east is the Town of Sheffield. The Town is located within the Taconic Mountain range with Mount Everett to the east and Alander Mountain to the west. It is a secluded town with only three roads that lead out of the town, and only one, East Street, connected to the rest of Massachusetts through Egremont. Bash Bish Falls State Park is located in the town and serves as a popular natural attraction.

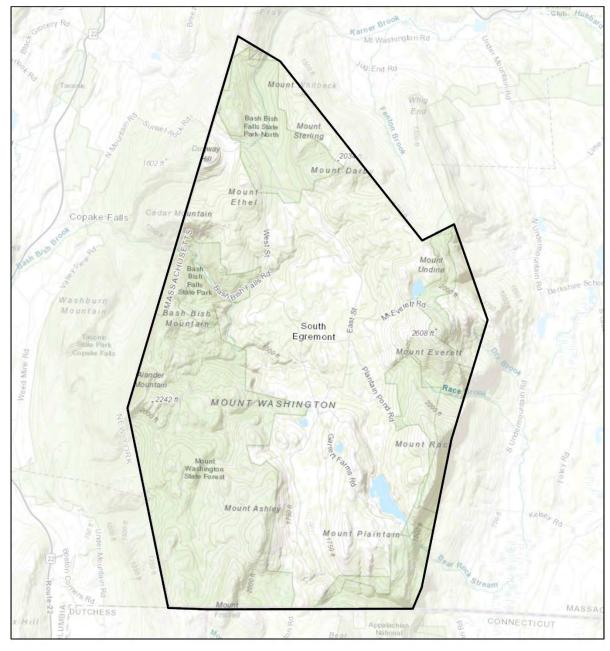
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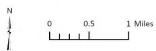
<sup>&</sup>lt;sup>2</sup> 2020 Decennial Census

Figure 1.2. Topographical Map of Mount Washington

Topographic Map







This map was created by the Berkshire Regional Planning Commission and is intended for general planning purposes only. This map shall not be used for engineering, survey, legal, or regulatory purposes. MassGIS, MassDOT, BRPC or the municipality may have supplied portions of this data.

Source: BRPC, 2021.

# Mitigation Planning History

The Town of Mount Washington was included in a regional hazard mitigation plan with 22 other Berkshire County municipalities. This original hazard mitigation planning which covered 19 municipalities was approved by FEMA Region 1 in 2012. A follow-up addendum which included Mount Washington as well as three other towns was adopted by the Town August 21st, 2015. This plan is an update of the Berkshire County Hazard Mitigation Plan, dated November 5, 2012 and subsequent Berkshire County Hazard Mitigation Plan Addendum, dated September 15, 2015. This HMCAP is a single jurisdictional plan.



# **CHAPTER 2: PLANNING PROCESS**

44 CFR § 201.6(b) & 44 CFR § 201.6(c)(1)

#### Introduction

This chapter outlines the development of the Town of Mount Washington Hazard Mitigation and Climate Adaptation Plan. It identifies who was involved in the process, how they were involved, and the methods of public participation that were employed. An open public involvement process during the drafting stage was essential to the development of the HMCAP. A discussion of how the community will continue public participation in the plan maintenance process (44 CFR § 201.6(c)(4)(iii)) will be discussed in Chapter 4.

The Town retained the Berkshire Regional Planning Commission (BRPC) to aid them in developing the HMCAP and the MVP Plan. The Mount Washington HMCAP is a compilation of data collected by BRPC, information gathered from the Mount Washington Hazard Mitigation / Municipal Vulnerability Preparedness Committee (the Committee) during meetings, and interviews conducted with key stakeholders outside of working meetings. The Mount Washington HMCAP reflects comments provided by participants and the public through the MVP planning process, the Planning Committee, local officials and citizens, neighboring towns, and ultimately MEMA and FEMA.

## Planning Meetings and Participation

44 CFR § 201.6(c)(1)

During the HMCAP planning process there was opportunity for public comment by town residents as well as neighboring communities, local and regional agencies or partners involved in hazard mitigation activities, and agencies that have the authority to regulate development. In addition, input was sought from businesses, academics and other private and non-profit interests, during the planning process. Making the document available to the public for review meets requirements of 44 CFR § 201.6(b)(1), and solicitation of comment from neighboring towns meets requirements of 44 CFR § 201.6(b)(2), pertaining to involvement of regional partners in the planning process. See Appendices for documentation.

In August 2021 the Town of Mount Washington formed the Hazard Mitigation / Municipal Vulnerability Preparedness Committee (the Committee) to steer the process. Members of the Planning Committee include town department heads, Town Boards and representatives from the citizenry. The Planning Committee members are listed in Table 2.1.

The Planning Committee held a series of meetings to assemble data on the Town's infrastructure, identify known hazards to residents, including visitors and seasonal residents, and review existing plans, procedures, bylaws and protections already in place. The Committee met 15 times between August 2021 and November 2022. In Spring 2022, the Committee held a three-part series of Community Resilience-Building Workshops online over Zoom on March 16<sup>th</sup>, March 23<sup>rd</sup>, and April 5<sup>th</sup>. Twenty-six people attended consisting of town officials, residents, neighboring town representatives, community groups, stakeholder organizations, and emergency responders. Mount Washington utilized the CRB workshop to collect input from as diverse a group of community members and stakeholders as possible with particular outreach to climate vulnerable populations such as the elderly and student groups. Invitations were sent to residents and stakeholders through emails, phone calls, and flyers. Core team

members contacted invitees directly to encourage participation and ensure receipt of an invitation. Workshop participants are listed in table 2.3.

**Table 2.1: Workshop Attendee List** 

Emily Lange Berkshire Regional Planning Commission Carrieanne Petrik MVP Regional Coordinator for Berkshires and Hilltowns  HM/MVP Core Team  Jim Lovejoy Mt. Washington Select Board Ellie Lovejoy Mt. Washington Board of Health and former EMD Nancy Wright Mt. Washington Former Planning Board Member Mack Waggaman Mt. Washington Conservation Commission, Invasives Committee Judy Isacoff Mt. Washington Resident and owner of Nature's Turn  Workshop Attendees  Eric Mendelsohn Mt. Washington Select Board Brian Tobin Mt. Washington Select Board Brian Tobin Mt. Washington Council on Aging Elisabeth Lem Mt. Washington Office Manager Rod Parlee Appalachian Mountain Club Doug Brown Berkshire Natural Resources Council Jessica Speer-Holmes Camp Hi-Rock Chris Ricard Copake Taconic State Park, Bash Bish Falls Elia Del Molino Greenagers Angela Sirois-Pitel The Nature Conservancy Rene Wendell The Nature Conservancy Andy Traines Mt. Washington Resident Harriet Bergmann Mt. Washington Resident Harriet Bergmann Mt. Washington Resident Marc Spiegel Mt. Washington Resident Marc Spiegel Mt. Washington Resident Vanessa Gang Mt. Washington Resident Vanessa Gang Mt. Washington Resident Liz Nash Mt. Washington Seasonal Resident Reuel Nash Mt. Washington Seasonal Resident	able 2.1: Workshop Attendee List			
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Elia Del Molino Greenagers Angela Sirois-Pitel The Nature Conservancy Rene Wendell The Nature Conservancy Andy Traines Mt. Washington Resident Hans Bergmann Mt. Washington Resident Harriet Bergmann Mt. Washington Resident Judy Whitbeck Mt. Washington Resident Marc Spiegel Mt. Washington Resident Tom Furcht Mt. Washington Resident Vanessa Gang Mt. Washington Resident Liz Nash Mt. Washington Seasonal Resident Reuel Nash Mt. Washington Seasonal Resident	Jessica Speer-Holmes	Camp Hi-Rock		
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Hans Bergmann Mt. Washington Resident Harriet Bergmann Mt. Washington Resident Judy Whitbeck Mt. Washington Resident Marc Spiegel Mt. Washington Resident Tom Furcht Mt. Washington Resident Vanessa Gang Mt. Washington Resident Liz Nash Mt. Washington Seasonal Resident Reuel Nash Mt. Washington Seasonal Resident	Rene Wendell	The Nature Conservancy		
Harriet Bergmann Mt. Washington Resident Judy Whitbeck Mt. Washington Resident Marc Spiegel Mt. Washington Resident Tom Furcht Mt. Washington Resident Vanessa Gang Mt. Washington Resident Liz Nash Mt. Washington Seasonal Resident Reuel Nash Mt. Washington Seasonal Resident	Andy Traines	Mt. Washington Resident		
Judy Whitbeck Mt. Washington Resident  Marc Spiegel Mt. Washington Resident  Tom Furcht Mt. Washington Resident  Vanessa Gang Mt. Washington Resident  Liz Nash Mt. Washington Seasonal Resident  Reuel Nash Mt. Washington Seasonal Resident	Hans Bergmann	Mt. Washington Resident		
Marc Spiegel Mt. Washington Resident  Tom Furcht Mt. Washington Resident  Vanessa Gang Mt. Washington Resident  Liz Nash Mt. Washington Seasonal Resident  Reuel Nash Mt. Washington Seasonal Resident	Harriet Bergmann	Mt. Washington Resident		
Tom Furcht Mt. Washington Resident  Vanessa Gang Mt. Washington Resident  Liz Nash Mt. Washington Seasonal Resident  Reuel Nash Mt. Washington Seasonal Resident	Judy Whitbeck	Mt. Washington Resident		
Vanessa Gang Mt. Washington Resident Liz Nash Mt. Washington Seasonal Resident Reuel Nash Mt. Washington Seasonal Resident	Marc Spiegel	Mt. Washington Resident		
Liz Nash Mt. Washington Seasonal Resident Reuel Nash Mt. Washington Seasonal Resident	Tom Furcht	Mt. Washington Resident		
Reuel Nash Mt. Washington Seasonal Resident	Vanessa Gang	Mt. Washington Resident		
ū	Liz Nash	Mt. Washington Seasonal Resident		
Tom Clapp Mt. Washington New Resident	Reuel Nash	Mt. Washington Seasonal Resident		
	Tom Clapp	Mt. Washington New Resident		

#### Public Outreach Methods

The Town of Mount Washington has an active "Home News and Announcements" page, where all materials related to the development of this plan were posted. Meetings related to plan development were also posted on the town calendar and an email blast went out to Town board members. Flyers were distributed at the Mount Washington transfer station, the only trash service in the area.

In an effort to reach as many residents as possible, the Town issued a public survey that asked respondents to describe the natural hazards that they had experienced and the concerns that worry them most about hazard events, including climate change impacts. The survey, which was offered online and in paper form was open for three months, during which the Town received a total of 30 responses (nearly 20% response rate). The Town promoted the survey and the planning process by placing notices on the Town's main web page, news/announcement page, through full-page color flyers handed out at the Mount Washington transfer station, distribution through Town Hall, announcements during Select Board meetings and during a public information session and through email to Town board and commission members.

The Town hosted two public presentations, on January 19<sup>th</sup>, 2022 and on April 20<sup>th</sup>, 2022 to inform community members and stakeholders of the planning process, gather information, and present of the major findings of the planning process. The presentations were held in accordance with the Massachusetts Open Meeting Law and promoted through the same channels as the public survey, via the town's web page, announcements, direct email blasts, and through flyering at public places. During the presentation the public was invited to provide feedback on the major findings and to review the materials posted on the Town's website, including a recording of the presentations. At this time the public was also invited to review and comment on the draft HMCAP, which would be offered for public review.

## Public Comment on the Draft MVP Plan and HMCAP

The Draft HMCAP, along with the public presentation, was posted on the Town of Mount Washington website and on October 21st. The posting automatically sends notices to residents subscribing to the ealert system. Emails to review and comment on the draft plan were sent directly to individual respondents of the public survey who requested that they be kept apprised of milestones during the hazard mitigation project. Paper copies of the draft plan were also placed in the Mount Washington Town Hall and Library for those with little or no internet access. The plan's posting was also announced at Mount Washington Select Board meetings during this time period. All neighboring Towns, local nonprofits, community groups, and the Southern Berkshire Regional Planning Committee (REPC) were formally invited to review and comment on the draft plan. See Appendix B for more details.

Comments received during the public comment period were incorporated into the final draft plan that was submitted to MEMA.

PLACEHOLDER – SIGNIFICANT PUBLIC COMMENTS ADDRESSED HERE

## Municipal Vulnerability Preparedness (MVP) Workshop

The central objective of the workshop was to first review regional weather events from the past and climate change data and projections, then collect local data from attendees to help:

- 1. Define top local natural and climate-related hazards of concern;
- 2. Identify existing and future strengthen and vulnerabilities;
- 3. Develop prioritized actions for the community;
- 4. Identify immediate opportunities to collaboratively advance actions to increase resilience.

#### Categories of Concerns and Challenges

Major themes that came out of the initial public participation in Mount Washington highlighted the common vision residents and stakeholders have for the resilience of the entire region. These themes were about more than specific concerns or challenges, but about how they wanted to address vulnerabilities and build upon existing strengths. The following summarizes categories that will be discussed in further detail throughout the plan with specific steps to accomplishing the vision in the Action Plan detailed in the Mitigation Strategy.

#### Roadways

As mentioned, Mount Washington is secluded. It has only three roads that lead out of town and only one, East Street, that connects to the rest of Massachusetts through Egremont. The town's roadway network is made up of paved roads, gravel roads, and dirt roads. A common theme that emerged among workshop participants was the desire to address drainage issues along local roadways and particularly, preventing dirt roads from turning to mud roads after rain or after thawing out from being frozen. Developing a comprehensive plan to manage roadways along with establishing a routine protocol for storm drain/catch basin cleaning was identified as an avenue for addressing this topic. Roadways identified as suffering from these issues include Falls Road, southern East Street, West Street, Mountain Road, Garrett Farms Drive, Club Grounds Road, Salisbury Road, along with long, shared driveways.

#### Culverts

Directly related to roadway degradation and flooding is the topic of culverts. Culverts typically consist of a metal or plastic pipe, with varying dimensions, that allow water (a stream) to flow underneath the roadway from one side to the other. In addition to passing water, culverts can also represent a barrier to or bridge for aquatic organism movement/passage (such as a brook trout headed upstream to spawn). Of all the regions in the U.S., the Northeast has seen the most dramatic increase in the intensity of rainfall events. The most recent U.S. National Climate Assessment reports that between 1958 and 2010, the Northeast saw more than a 55% increase in the amount of precipitation falling in very heavy events (defined as the heaviest 1% of all daily events). With an increase in the frequency and intensity of precipitation events, the need to upsize culverts to accommodate new water levels and flow rates was identified as an important resiliency strategy. As such, the town has identified the need to develop a plan for replacing undersized culverts that also provide for aquatic organism passage. An element of this plan will also consider developing a protocol where residents can monitor known problem sites and report any issues to the town. Specific locations identified include East Street, Plantain Road, and Old Plantain Pond Road.

#### Sediment Deposition

Also related to roadway degradation and flooding is the topic of sediment transport and deposition. Elevation gains along local roadways, slopes, and the steep hills, common geological features in Mount Washington, all contribute to sediment transportation and deposition. Exploring avenues for reducing sedimentation runoff and preventing it from entering local waterways was identified as an important action step. Moreover, workshop participants mentioned that residential driveways were a contributing factor to stormwater runoff/sediment transport. Thus, stakeholders suggested exploring an update to local regulations that would address residential driveway drainage, educating homeowners about runoff/sediment issues, and establishing a monitoring and reporting protocol for residents to identify new runoff/sediment issues. According to workshop participants, this issue occurs town-wide and specifically on the southern section of East Street.

#### *Internet/Communications*

The rural, secluded context of Mount Washington greatly influences the town's communication systems. In 2017, the town was equipped with fiber optic, taking the town from having no broadband internet at all to having the highest speeds in the county. According to town staff and workshop participants, most residents do not have landline telephones and instead, use their cell phones, connected to the internet through VOIP, to make calls. In the absence of being connected to a network, cell service coverage is spotty and mostly non-existent in most areas of town under most plans. This presents unique challenges while attempting to disseminate important information related to impending hazards and emergency response protocols. To address this issue, participants suggested exploring a satellite dish system to provide emergency communications including a network of satellite phones for residents to use in emergency situations.

Additionally, creating a central communication system for information sharing, such as a sign at Town Hall or other central meeting place residents are aware of, that allows for contribution from residents and communicates what resources exist and where.

#### Invasive Species

With 93% of land forested, and 80% of the town's land protected, access to nature is easy. As climate change continues to expand the ecological range of different plants and animals, the town will need to be conscious of the arrival of an increase in invasive species. Invasives such as stiltgrass and barberry are already present in town. According to one workshop participant, specific operations engaged in by the highway maintenance staff could be exacerbating the spread of certain invasives. The town's next step toward resilience includes developing a long-term invasives management plan that involves recruiting and training town staff and volunteers to map and eliminate invasives. The plan will also outline the risks of each invasive to native ecology, will lay the groundwork for collaboration with multiple actors and agencies to manage their spread, and will explore the viability of introducing other species that can provide similar ecosystems services while thriving in a new climate. Additionally, constructing a new highway garage that contains a washing bay for vehicles and personnel to eliminate the spread of invasives was also suggested.

#### Natural Resource Management & Biodiversity

With such a wealth of natural resources, workshop participants stressed the importance of cataloging the type of natural flora and fauna that occupy these spaces. Cataloging species that are present will provide a baseline and allow for tracking how ecosystem dynamics change with the climate. Workshop participants were particularly keen on the need to develop a comprehensive natural resources

management plan to maintain and enhance the town's natural assets including old growth forests, vernal pools, and water resources more generally.

#### Visitor Management

Mount Washington's natural recreational areas draw residents and visitors year-round. At no time was this more true than during the height of the COVID-19 pandemic, particularly during the summer months, when the town saw numerous visitors traveling to Mount Washington State Forest or Bash Bish State Park. Since then, it has become apparent that these places need better management strategies as the high volume of visitors seen during the pandemic resulted in numerous traffic and parking violations which, in some instances blocked emergency vehicle access. Workshop participants identified the need to educate residents and visitors to these natural spaces on safety protocols and environmental stewardship strategies to increase management and oversight of these areas in partnership with state and land trusts who own the bulk of the property. Additionally, more traffic signage to prevent dangerous driving was a suggested intervention.

#### Wildfire

The town considers itself to be at high risk to wildfires due to the type of forests as well as its climate. The Mt. Everett State Reservation, Mt. Washington State Forest, and Van Der Smissen Memorial are areas of particular concern, especially at high elevations. While there have been no reports of wildfires in the town since the Great Taconic Wildfire of 1930 there has been numerous reports of smoldering (MEMA, 2004, town representatives). The town could not obtain local records on fires since 2000 and the state could not provide more recent information.

Given the forested character of Mount Washington along with its heavily forested neighboring communities, the risk of wildfire is certainly a consideration. The risk of fire being able to become established and spread is greater here since the responding volunteer fire department is in neighboring Egremont or Copake, NY. It can take thirty-minutes to respond to fires here due to the distance firefighters must travel. As such, workshop participants suggested the town develop a fire management plan that addresses fire breaks and culling of specific areas to mitigate wildfire risk. Additionally, participants stressed the need for the town to have the ability to issue fire hazard alerts or Red Flag warnings on the town's website. Lastly, it was also suggested that the town solicit local first responders to volunteer in the Egremont Fire Department which covers Mount Washington.

#### Emergency Management & Preparedness (Isolation)

Due to the sparse development pattern scattered around town, one can easily feel isolated. Ensuring that residents who are physically isolated from other homes or town buildings have all the adequate information needed to respond accordingly to a given hazard is paramount to enhancing resiliency. Mount Washington has an Emergency Preparedness Plan in place. Participants suggested a review of this document for effectiveness and improvement would be beneficial. Moreover, many residents were not aware of an existing Emergency Preparedness Plan indicating that the Town may benefit from outreach and information about plan details.

#### **Emissions**

Naturally, enhancing resilience includes mitigating greenhouse gas emissions that are driving and accelerating change. As more technologies to reduce emissions emerge, and as more towns begin implementing their use, opportunities for decarbonization abound. Workshop participants suggested the town encourage energy efficiency measures in new and existing buildings, potentially through

updates to the town's regulations. Additionally, participants felt it would be worthwhile to provide information on energy reduction technologies to educate homeowners of their options and any available financing programs that might help offset costs. Such benefits exist at the State level through the Mass Save program.

#### **Town Capacity**

During one of the workshops, there was a discussion among participants that touched on how the town might go about attracting skilled laborers and workers to either volunteer with the town or come and live in Mount Washington. Workshop participants felt it important for the town to identify the skills that are most needed, such as grant writing, medical expertise, or those experienced with incident command system management, and then to identify ways of attracting current or prospective residents to assist the town in achieving desired outcomes. Workshop participants also felt it important for the town to place more emphasis on creating regional alliances among different state agencies and conservation organizations. As we have learned by now, enhancing resilience includes actions such as building up relationships and expanding the network of individuals with specialized skills that can assist the town.

# Incorporation of Existing Information 44 CFR § 201.6(b)(3)

No plan should be created in a silo, particularly a hazard mitigation plan because of its applicability to land use, municipal and emergency services, and vulnerable people. This is especially important for small towns like Mount Washington who work closely with their neighbors to address issues on a larger, regional scale. This HMCAP update incorporates relevant data and information from existing plans, plans in development, studies, reports and technical information. Main data sources and local plans include:

- Berkshire County Hazard Mitigation Plan, 2012
- Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP), 2013, 2018
- BioMap2, Conserving the Biodiversity of Massachusetts in a Changing World, Mount Washington, 2012.
- Mount Washington Emergency Management Plan, 1999

This plan should be used in conjunction with other local and regional plans, specifically transportation and capital improvement programs and emergency preparedness planning.

#### Plan Structure

The next chapter of this plan will analyze risk, profiling each hazard with potential to affect the Town of Mount Washington. After a general profile of the Town's assets and vulnerabilities, each hazard analyzed includes a hazard profile and vulnerability assessment. Hazard profiles consist of likely severity, probability, geographic areas likely impacted, and historic data.

The Risk Assessment discusses hazard effects on people including vulnerable groups, the built environment including infrastructure, the natural environment, the economy, and future conditions to the extent reasonably foreseen in consideration of climate change. Table 3.2 illustrates part of the

process of prioritizing hazard mitigation actions in addition to the profiling of local impacts during the risk assessment. The method of prioritization meets requirements of 44 CFR § 201.6(c)(3)(iii).

# Hazard Mitigation Goals

In developing this plan, the Town of Mount Washington is taking action to reduce or avoid long-term vulnerabilities to the hazard identified in the following chapter. The following are the Town's goals for this hazard mitigation plan:

- 1. Ensure road security
- 2. Ensure fiber/communication redundancy and cyber security
- 3. Manage forests to reduce fire hazard and protect our natural resources
- 4. Manage invasive species

# **CHAPTER 3: RISK ASSESSMENT**

44 CFR § 201.6(c)(2)

#### **FEMA Requirements**

In accordance with 44 CFR § 201.6 (c)(2), this risk assessment provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. The risk assessment is an analysis of the hazards and risks facing the Town of Mount Washington and contains hazard profiles and loss estimates to serve as the scientific and technical basis for mitigation actions. This chapter also describes the decision-making and prioritization processes to demonstrate that the information analyzed in the risk assessment enabled the Town to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. This section also provides information on previous occurrences of hazard events and on the probability of future hazard events with consideration of climate change (44 CFR § 201.6(c)(2)(i)).

This plan also includes a section on Invasive Species and a section on Cyber Security hazards because this is a growing threat that could disable critical facilities and the essential services they provide to the community.

#### **People**

The total population according to the according to the 2020 United States Census is 158, with an average of approximately 7 people per square mile. There are approximately 143 households in Mount Washington, with an average of 1.03 persons per household. According to the American Community Survey, the median age of the population is 54.8 years, 15% higher than Berkshire County median age of 47.7 and 28% higher than Massachusetts (which has a median age of 39.7 years). Median household income for Mount Washington residents is \$66,250, which is slightly higher than the median income for Berkshire County and is approximately 77% of the median household income for Massachusetts (which is \$85,843). Approximately 14.9% of persons live in poverty, 4 points higher than Berkshire County as a whole, which is 10.9%.<sup>3</sup>

Mount Washington is a bedroom community, where most residents commute to employment centers in southern and central Berkshire County. A large portion of year-round residents (44.2%) are retired. Due to its location and limited road system and rural location, an average commute is approximately 30 minutes. For this reason, a good portion of residents (nearly 20%) work from home. Of those that do commute, 87.8% work in Berkshire County and 11% work in nearby Connecticut or New York. Approximately 51% of the housing units are seasonally occupied, with landowners coming primarily from New York City and other northeast metropolitan areas.

There is no school in Mount Washington – students attend regional schools in nearby Egremont (1<sup>st</sup> grade) and Sheffield (grades 2-12). There are no commercial businesses within Mount Washington – residents must travel to neighboring communities for all their needs, including groceries, health care, vehicle fuels, etc.

<sup>&</sup>lt;sup>3</sup> U.S. Census Bureau (2019). American Community Survey 5-year estimates. Retrieved from Census Reporter Profile page for Mount Washington, Berkshire County, MA https://data.census.gov/cedsci/table?q=Mount%20Washington,%20ma&tid=ACSST5Y2019.S1901 Margin of error is at least 10 percent of the total value.

Mount Washington land is largely dominated by open space and natural areas that attract a growing number of visitors. There is one overnight camp located in Mount Washington, YMCA Hi-Rock, that provides summertime programming and winter retreats for children and families. Other recreational resources in town include Bash Bish Falls State Park in the northwestern part of Town, Mount Everett Reservation in the northeast, and Mount Washington State Forest on the western and eastern borders – all managed by Massachusetts Department of Conservation and Recreation (DCR). There are seven hike-in camping areas. Two are in Mt. Washington State Forest, a cabin and campsite on the Alander Mountain Trail. Two are along the Appalachian Trail in the southern area of Town, Sages Ravine campsite and Laurel Ridge campsite. Three sites are located in the eastern Mt. Everett State Reservation; a campsite at Race Brook, the Hemlocks and Glen Brook Lean-to. The Appalachian National Scenic Trail (known locally at the AT), runs the full length of the eastern portion of Town, from Connecticut through to Egremont.

#### **Economy**

Mount Washington is a bedroom community that relies on residential real estate and private property taxes. There are no commercial businesses in the Town except for the Austin Blueberry Farm, although many residents have businesses in which they can work from home or are based at home.

#### **Natural Environment**

The predominant land uses in Mount Washington are forest (93%), open water and wetlands (3%). Residential, commercial, and industrial lands combined cover slightly more than one percent of the Town (MassGIS, 2016). See Figure 3.1 for reference.

Mount Washington's forests and wetlands are of high value given that they are relatively undisturbed by development and are found at higher elevations than typically found in southern New England. The Town hosts Landscape Blocks, which are large areas of intact predominately natural vegetation, consisting of contiguous forests, wetlands, rivers, lakes, and ponds and experience little human disturbance. These large Landscape Blocks are most likely to maintain dynamic ecological processes such as buffering, connectivity, natural disturbance, and hydrological regimes, all of which help to support wide-ranging wildlife species and many other elements of biodiversity<sup>4</sup>.

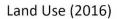
The mountains that ring the Town are part of a very large and complicated Core Habitat on southwestern Berkshire County, expanding outward into Egremont and Sheffield. Ecological features within this area include Priority Natural Communities and Species of Conservation Concern, including 25 rare plants and animal species. Of the almost 36,000 acres of this extended Core Habitat area, 17,586 acres are within Mount Washington. Seven Priority and Exemplary Natural Communities survive here:

- Calcareous Talus Forest/Woodland
- Hemlock Ravine Community
- Hickory-Hophornbeam Forest/Woodland
- Mixed Oak Forest
- Northern hardwoods Hemlock-While Pine forest
- Rich, Mesic Forest Community
- Ridgetop Pitch Pine Scrub Oak Community<sup>5</sup>

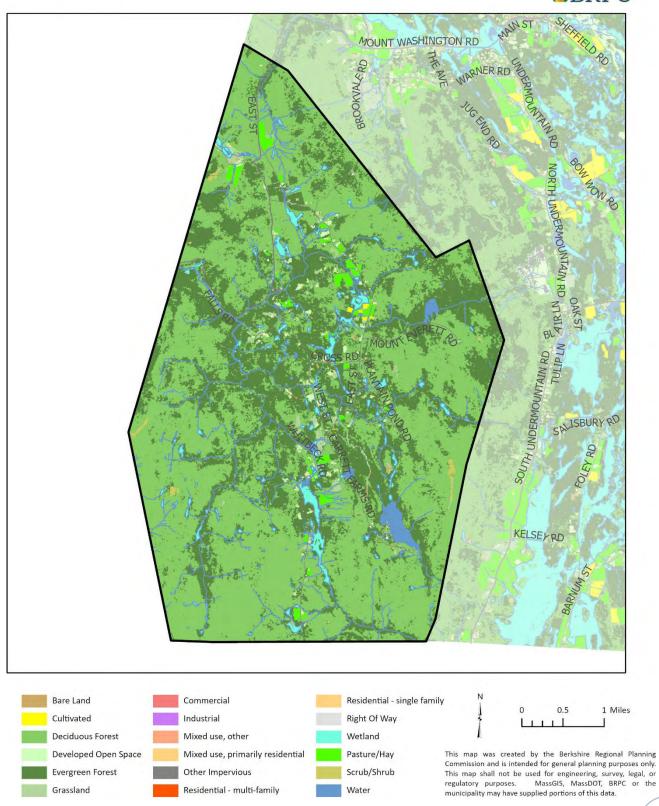
<sup>5</sup> NESP, 2012a.

<sup>&</sup>lt;sup>4</sup> NHESP, 2012b.

Figure 3.1: Town of Mount Washington Land Use 2016







#### **Built Environment**

A list of the critical facilities within the community is shown in Table 3.1. This data was taken from the Town's existing hazard mitigation plan and revised during the data collection process. These facilities were digitized into GIS and used for determining vulnerability to the various hazards. The Town of Mount Washington utilizes its two municipal buildings, the Town Hall and DPW Garage, for numerous purposes.

**Table 3.1. Critical Facilities – Mount Washington** 

Туре	Name	Address
Temporary Morgue	The Potato Storage Building	East Street
Health Services	Town Hall/Dept. Public Works (DPW)	118 East St./5 Cross St.
Staging Areas	DPW/Town Hall/Camp Hi Rock	5 Cross St./118 East St./162 East St.
Mass Care Shelters	Town Hall/Church of Christ/Dept. Public Works	118 East St./East St./5 Cross St.
Special Needs Facility	Camp Hi Rock	162 East St.
Camp	Camp Hi Rock	162 East St.
<b>Emergency Operations Center</b>	Town Garage	5 Cross Road
Alternate EOC	Town Hall	118 East St.

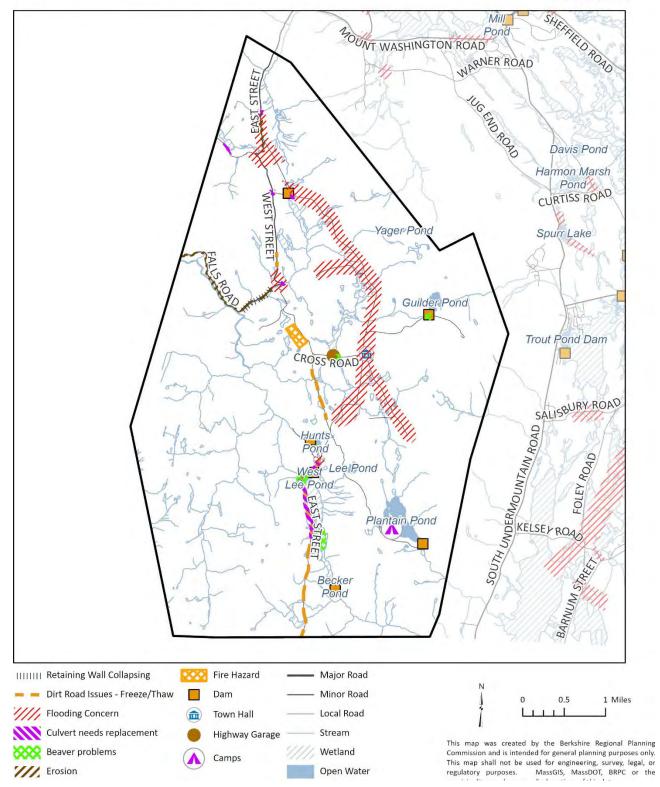
There are approximately 17.43 miles of roads in Mount Washington, all of which are owned and maintained by the Town, three of which travel through state-owned land. There are no state roads within the town. The New York State Route 344 enters the town to provide access to Bash Bish Falls from Route 22.

There is no public drinking water system; all potable water is supplied by private wells. There is no sewer system, all residents and businesses use septic systems.

Figure 3.2: Town of Mount Washington Critical Facilities and Areas of Concern

Critical Facilities & Areas of Concern





#### Hazard Identification and Risk Assessment Processes

In order to identify potential hazards that can affect the Town of Mount Washington, several resources were utilized. The information outlined in the 2012 *Berkshire County Hazard Mitigation Plan* and in the hazard mitigation plans of neighboring towns served as a foundation on which to build. The hazards identified in the 2012 regional plan were Flooding, Dam Failure, Wildfire, Snow, High Wind, and Other Natural hazards (i.e. severe storms and tornadoes). In order to build upon this list, the 2018 *Massachusetts State Hazard Mitigation and Climate Adaptation Plan* (SHMCAP) for the Commonwealth of Massachusetts was consulted. Accounting for the location, natural and built environments, history, and scientific studies of the area, it was determined that the Town of Mount Washington must plan for the following hazards:

- Severe Winter Event (Ice Storm, Blizzard, Nor'easter)
- Hurricane & Tropical Storms
- Flooding (including Dams, Ice Jam, Beaver Activity)
- Severe Storms (High Wind, Thunderstorms,)
- Drought
- Invasive Species
- Annual / Extreme Temperatures
- Tornado
- Wildfire
- Invasive Species
- Landslide
- Earthquake
- Cyber Attacks

#### Prioritization and Hazard Profiles

Table 3.2 illustrates the first step in the process of prioritizing hazard mitigation actions in addition to the profiling of local impacts during the risk assessment. The method of prioritization meets requirements of 44 CFR § 201.6(c)(3)(iii). After reviewing information from the 2012 regional hazard mitigation plan, discussing weather patterns and natural hazards that have occurred in the Town and the region since that time, and considering changing weather patterns expected due to climate change, the Committee worked through and attempted to quantify potential effects of natural hazards on Mount Washington and its residents. Prioritization also considered public input that residents provided to the Committee through a town-wide survey. Hazards other than flooding are difficult to prioritize without this or a similar ranking system.

Table 3.2: Hazard Prioritization for the Town of Mount Washington

Hazard	Area of Impact	Frequency of	Magnitude /	Hazard
	Rate 1=small	Occurrence Rate 0 = Very low	Severity Rate 1=limited	Ranking
	2=medium	0 = very low 1 = Low	2=significant	
	3=large	2 = Medium	3=critical	
	go	3 = High Frequency	4=catastrophic	
Severe Winter Event (Ice Storm, Blizzard, Nor'easter)	1	0.6	1	2.6
Hurricane & Tropical Storms	2.3	3	3	8.3
<b>Flooding</b> (including Dams, Ice Jam, Beaver Activity)	2.3	2.3	2	6.6
High Wind, Thunderstorms	2.6	2.3	2.3	7.2
Drought	2	1	2.3	5.3
Invasive Species	2	2	2.3	6.3
Annual / Extreme Temperatures	1	0.3	1.6	2.9
Tornado	1.3	0	1	2.3
Wildfire	2.3	1	2.6	5.9
Cyber Security	1.3	0.3	2	3.3
Landslide	2.6	3	2.6	8.2
Earthquake	2	2.6	2.3	6.9
Area of Impact				
1=small	isolated to a specific a	area of town during one ev	ent	
2=medium	occurring in multiple areas across town during one event			
3=large	affecting a significant portion of town during one event			
Frequency of Occurrence				
0=Very low frequency	events that have not occurred in recorded history of the town, or that occur less than once in 1,000 years (<0.1% per year)			
1=Low frequency	events that occur from once in 100 years to once in 1,000 years (0.1% - 1% per year)			
2=Medium frequency	events that occur from once in 10 years to once in 100 years (1% - 10% per year)			
3=High frequency	events that occur more frequently than once in 10 years (>10% per year)			
Magnitude/Severity				
1=limited	injuries and/or illnesses are treatable with first aid; minor "quality of life" loss; shutdown of critical facilities and services for 24 hours or less; property severely damaged <10%			
2=significant	injuries and/or illnesses do not result in permanent disability; shutdown of several critical facilities and services for more than one week; property severely damaged <25% and >10%			
3=critical	injuries and/or illnesses result in permanent disability; complete shutdown of critical facilities for at least two weeks; property severely damaged <50% and >25%			
4=catastrophic	multiple deaths; complete shutdown of facilities for 30 days or more; property severely damaged >50%			

# Severe Winter Storms (Ice Storms, Nor'easters, Blizzards)

#### Hazard Profile

Snow and other winter precipitation occur very frequently across the entire Commonwealth. According to the 2018 SHMCAP, the average annual snowfall for the snowiest municipality in each of four regions are:

• Chatham (Cape Cod and Islands): 28.9 inches

• Milton (Eastern MA): 62.7 inches

East Brimfield (Central MA): 59.0 inches

• Worthington (Western MA): 79.7 inches

Severe winter storms in Mount Washington typically include heavy snow, blizzards, Nor'easters, and ice storms. Due to its higher elevations, the Town's temperatures are a few degrees cooler than its neighboring communities, creating icy or snowy conditions in the Town when neighbors in Egremont, Sheffield and Copake are receiving rain.

A blizzard is a winter snowstorm with sustained or frequent wind gusts to 35 mph or more, accompanied by falling or blowing snow reducing visibility to or below a quarter mile. These conditions must be the predominant condition over a three-hour period. Extremely cold temperatures are often associated with blizzard conditions but are not a formal part of this definition. However, the hazard created by the combination of snow, wind, and low visibility increases significantly with temperatures below 20°F. A severe blizzard is categorized as having temperatures near or below 10°F, winds exceeding 45 mph, and visibility reduced by snow to near zero (MEMA, 2013).

A Nor'easter is typically a large counterclockwise wind circulation around a low-pressure center often resulting in heavy snow, high winds, and rain. Strong areas of low pressure often form off the southern east coast of the U.S, moving northward with heavy moisture and colliding with cooler winter inland temperatures. Sustained wind speeds of 20-40 mph are common during a nor'easter, with short-term wind speeds gusting up to 50-60 mph or even to hurricane force winds (MEMA, 2013).

Ice storm conditions are defined by liquid rain falling and freezing on contact with cold objects creating ice build-ups of  $\frac{1}{2}$  inch or more that can cause severe damage. An ice storm warning, now included in the criteria for a winter storm warning, is for severe icing. This is issued when  $\frac{1}{2}$ -inch or more of accretion of freezing rain is expected. This may lead to dangerous walking or driving conditions and the pulling down of power lines and trees. (MEMA, 2013)

#### Likely Severity

Periodically, a storm will occur which is a true disaster, and necessitates intense, large-scale emergency response. The main impacts of severe winter storms in the Berkshires are deep snow depths, heavy ice accumulations, high winds and reduced visibility, potentially resulting in the closing of schools, businesses, some governmental operations and public gatherings. Loss of electric power and possible closure of roads can occur during the more severe storms events. The magnitude or severity of a severe winter storm depends on several factors including a region's climatological susceptibility to snowstorms,

snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day (e.g., weekday versus weekend), and time of season (MEMA, 2013).

NOAA's National Climatic Data Center (NCDC) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the U.S. The RSI ranks snowstorm impacts on a scale from one to five. RSI is based on the spatial extent of the storm, the amount of snowfall, and the combination of the extent and snowfall totals with population. Data beginning in 1900 is used to give a historic perspective (MEMA 2013, NOAA 2018).

**Table 3.3 Regional Snowfall Index Ranking Categories** 

Category	Description	RSI-Value
1	Notable	1-3
2	Significant	3-6
3	Major	6-10
4	Crippling	10-18
5	Extreme	18+

Source: MEMA 2013.

Of the 12 recent winter storm disaster declarations that included Berkshire County, only two events were ranked as Extreme (EM-3103 in 1993 and DR-1090 in 1996), one was ranked Crippling (IM-3175 in 2003) and two were ranked as Major (EM-3191 in 2003 and DR-4110 in 2013). It should be noted that because population is used as a criteria, the storms that rank higher will be those that impact densely populated areas and regions such as Boston and other large cities and, as such, might not necessarily reflect the storms that impact lightly populated areas like the Berkshires. For example, one of the most famous storms in the Commonwealth in modern history was the Blizzard of '78, which dropped over two feet of snow in the Boston area during 65 mph winds that created enormous drifts and stranded hundreds of people on local highways. The storm hit the snow-weary city that was still digging out of a similar two-foot snowstorm 17 days earlier. On the Berkshires, things were not that severe, with 11-19 inches of snow falling in the county over the course of the 33-hour storm. Winds of up to 50 mph and dropped visibility to zero. Berkshire County was not listed in the disaster declaration.

The Northeast States Consortium has been tracking one- and three-day record snowfall totals. According to their data, 99% of the one-day record snowfall events in the region typically yield snow depths in the range of 12"-24", while the majority of three-day record snowfall events yield snow depths of 24"-36" (Table 3.4).

Table 3.4. Record Snowfall Events and Snow Depths for Berkshire County

Record Snowfall Event	Snowfall 12"-24"	Snowfall 24"-36"
1-Day Record	99%	1%
3-Day Record	36%	64%

Source: Northeast States Consortium, 2017.

One of the most serious storms to impact

communities in the Berkshires was the Ice Storm of December 11, 2008. The storm created widespread downed trees and power outages all across New York State, Massachusetts and New Hampshire. Over one million customers were without electricity, with 800,000 without power three days later and some without power weeks later. While this storm severely impacted the hilltowns in central and northern Berkshire County, Mount Washington, like its south county neighbors, was fortunate in that it received little damage from this storm.

While severe winter weather declarations became more prominent starting in the 1990s, it is not believed that this reflects more severe weather conditions than the Berkshires experienced in the 40+ years prior to the 1990s. Respected elders across Berkshire County comment that snow depths prior to the 1990s were consistently deeper that what currently occurs in the 2010-20s.

#### **Probability**

The majority of blizzards and ice storms are viewed by people in the region as part of life in the Berkshires, an inconvenience and drain on municipal budgets. Residents and municipal staff expect to deal with several snow storms and a few Nor'easters each winter. According to the NOAA-NCDC storm database, over 200 winter storm events occurred in the Commonwealth between 2000 and 2012, therefore, the subset of severe winter storms are likely to continue to occur annually (MEMA, 2013).

Using history as a guide for future severe winter storms, it is estimated that Mount Washington will be at risk for approximately six severe winter storms per winter. The highest risk of these storms occurs in January with significant risk also occurring in December through March. In general, the region is receiving less snowfall than in previous decades, with climate change projections indicating that warmer winter temperatures will result in higher percentages of winter precipitation falling as rain and/or sleet. This does not mean that the County will not experience years with high snowfall amounts, as the 2010-11 winter experienced more than 100 inches. It should be noted that although total snow depths may be reduced in the future, warmer winter temperatures will likely increase the number and severity of storms with heavy, wet snow or ice, which can bring concerns for road travel, human injuries, and risk of roof failures.

#### **Geographic Areas Likely Impacted**

Severe winter storm events generally occur across the entire area of Mount Washington. In general, most development follows roads that are located within the interior of the Town, where the terrain is relatively gentle as compared to the steeply sloped hills that form the Town borders. However, the only two access routes that are open in the winter are East Street and West Street / Falls Road, both of which are narrow roadways that travel through steeply sloped terrain. Keeping these routes open and safe for travel during severe winter conditions is critical for maintaining travel in and out of Mount Washington.

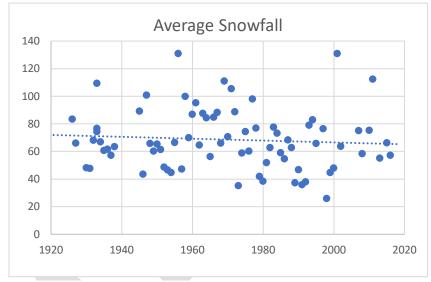
#### **Historic Data**

Although the entire community is at risk from severe winter storms, the higher terrains in the county tend to receive higher snowfall amounts, and these same areas may receive snow when the lower elevations received mixed snow/rain or just rain. Snow and other winter precipitation occur very frequently across the entire region. Snowfall in the region can vary between 26 and 131 inches a year, however it averages around 65 inches a year, down from around 75 inches a year in 1920. As can be seen in Figure 3.3, the average snowfall levels are trending downward.

The National Climatic Data Center, a division of NOAA, reports statistics on severe winter storms from 1993 through 2017. During this 24year span, Berkshire County experienced 151 severe winter storms, an average of six per winter. This number varies each winter, ranging from one during 2006 to 18 during 2008.

In Berkshire County, there are several notable blizzards and Nor'easters that have buried the region in historic snow depths. According to a recent feature in the *Berkshire Eagle* newspaper that summarized

Figure 3.3: Average Snowfall in Berkshire County



Source: NOAA, 2017.

historical news articles, there have been several notable winter storms. The Blizzard of 1888 began the evening of March 11 and lasted three days. Reported snow totals vary from 36 to 42 inches. What made the storm so memorable was the huge snowdrifts that came with it and the aftermath.

In March 1916 a cold spell and a series of storms would cut travel between towns and keep supplies from reaching the hinterlands. Although a two-day storm March 8 and 9 only brought 20" of snow, the county would receive an additional 44" by the end of the month. With no break in the cold temperatures, snowdrifts reaching upward of 20' became common, making roads impassable. On March 23, the *Berkshire Eagle* newspaper reported that the closure of the Lee-Otis line for the past two weeks had created a kerosene shortage in Otis. Residents had resorted to killing a "community steer" and its tallow was divided among the town's residents for candle-making. Farmers dug in deep, many taking up residence in their barns alongside their livestock, where they oversaw the arrival of lambs and calves. Trolley service came to a standstill for more than three weeks in some areas. The 22-foot drifts still remained when the Berkshire Street Railway Co. was finally able to break through April 12.

A storm in February 1934 dropped 2-3' of snow across the county, creating 12' snow drifts in Savoy and closing three major highways. Horses and a fire sleigh were brought back into service in North Adams and postal carriers donned snowshoes to deliver the mail. A storm that lasted 16 days in February-March of 1947 left more than 45" of snow across the county, with a one-day total of 16" falling on March 3. Additional notable storms through 2011, which were recorded in local news but not included as part of disaster declarations, occurred in 1969, 1987, 2001, 2002, 2007.

<sup>&</sup>lt;sup>6</sup> Berkshire Eagle, 2-2-19. "Memorable blizzards, nor'easters from 1888 to the present in the Berkshires."

Since 2000, two severe ice storm events have occurred in the region. The storms within that period occurred in December and January, but ice storms of lesser magnitudes may impact the region from October to April, and on at least an annual basis.

Based on all sources researched, known winter weather events that have affected Massachusetts and were declared a FEMA disaster are identified in the following sections. Of the 18 federally declared winter storm-related disaster declarations in Massachusetts between 1954 to 2018, Berkshire County has been included in 12 of those disasters. None have been declared in for the county since 2013. The number of disaster declarations for severe winter events in which Berkshire County was included is more than double that of declarations for non-winter, non-flood-related severe storm events.

Table 3.5: Severe Winter Weather – Declared Disasters that included Berkshire County 1992-2017

Incident Period	Description		
12/11/92- 12/13/92	Nor'easter with snow 4'+ in higher elevations of Berkshires, with 48" reported in Becket & Peru; snow drifts of 12'+; 135,000 without power across MA.		
03/13/93- 03/17/93	High winds & heavy snow; generally 20-30" in Berkshires; blizzard conditions lasting 3-6 hrs; Pittsfield receives 22" in 24 hrs; snowdrifts of 10' across county.*	EM-3103	
01/07/96- 01/08/96	Blizzard of 30+" in Berkshires, with strong to gale-force northeast winds; MEMA reported claims of approx. \$32 million from 350 communities for snow removal	DR-1090	
03/05/01- 03/06/01	Heavy snow across eastern Berkshires to Worcester County; several roof collapses reported; \$21 million from FEMA	EM-3165	
02/17/03- 02/18/03	Winter storm with snow of 12-24", with higher totals in eastern Berkshires to northern Worcester County; \$28+ million from FEMA		
12/06/03- 12/07/03	Winter Storm with 1'-2' across state: \$35 million from FEMA		
01/22/05- 01/23/05	Blizzard with heavy snow, winds and coastal flooding; highest snow falls in eastern Mass.; \$49 million from FEMA		
04/15/07- 04/16/07	Severe Storm and Flooding; wet snow, sleet and rain added to snowmelt to cause flooding; higher elevations received heavy snow and ice; \$8 million from FEMA	DR-1701	
12/11/08- 12/12/08	Major ice storm across eastern Berkshires & Worcester hills; at least $\frac{1}{2}$ " of ice accreted on exposed surfaces, downing trees, branches and power lines; 300,000+ customers without power in state, some for up to 3 wks.; \$49+ million from FEMA	DR-1813	
01/11/11- 01/12/11	Nor'easter with up to 2' within 24 hrs.; \$25+ million received from FEMA; Savoy received 40.5" and N. Adams received 33"*		
10/29/11- 10/30/11	Severe storm and Nor'easter with 1'-2' common; at peak 665,000 residents statewide without power; 2,000 people in shelters statewide; \$70+ million from FEMA statewide; Peru received 32" and Pittsfield received 18" *		
02/08/13- 02/09/13	Severe Winter Snowstorm and Flooding; \$65+ million from FEMA statewide	DR-4110	

Source: MEMA 2018, unless otherwise noted.

<sup>\*</sup> Berkshire Eagle, 2-2-19. "Memorable blizzards, nor'easters from 1888 to the present in the Berkshires."

# **Vulnerability Assessment**

#### **People**

Long-term residents of Mount Washington pride themselves on being independent and self-sufficient during severe winter events. During a public online survey, residents rated severe winter storms as the sixth most serious natural hazard that causes them concern, out of a total of 13 natural hazard events listed. Long-time, year-round residents are prepared to shelter in place for a few days if necessary. Typically, few seasonal homeowners are in their Mount Washington homes during the winter season, so the population during this season is the lowest. However, the recent COVID pandemic, coupled with the high integrity of the Town's broadband, has attracted more seasonal residents to live in their Mount Washington homes year-round. This trend may lead to longer-term population increases during the winter months. It is unknown how well new residents or seasonal residents are prepared to shelter in place during severe winter weather.

According to the NOAA National Severe Storms Laboratory, every year, winter weather indirectly and deceptively kills hundreds of people in the U.S., primarily from automobile accidents, overexertion, and exposure. Winter storms are often accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, drifting snow, and extreme cold temperatures with dangerous wind chill. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. Injuries and deaths may occur due to traffic accidents on icy roads, heart attacks while shoveling snow, or hypothermia from prolonged exposure to cold (MEMA & EOEEA, 2018).

Vulnerable populations include the elderly living alone, who are susceptible to winter hazards due to their increased risk of injury and death from falls, overexertion, and/or hypothermia from attempts to clear snow and ice, or injury and death related to power failures. The population over the age of 65, individuals with disabilities, and people with mobility limitations or who lack transportation are also more vulnerable because they are more likely to seek or need medical attention, which may not be available due to isolation during a storm event. The ability of emergency responders to respond to calls may be impaired by heavy snowfall, icy roads, and downed trees (MEMA & EOEEA, 2018). In extreme storms residents may be displaced or require temporary to long-term sheltering. In addition, downed trees, damaged buildings, and debris carried by high winds can lead to injury or loss of life.

Loss of electricity can lead to loss of communications, particularly in Mount Washington where the main conduit for communications is through the Town's broadband system. A general lack of cell phone coverage of much of the Town makes the loss of online communications even more concerning. During the public survey, residents indicated that overall their two greatest concerns from the effects of natural hazards are loss of electricity and becoming isolated.

In Mount Washington only two of the four roads that carry traffic in and out of the Town are open during the winter months, and both of these routes are along narrow, steeply sloped roads, where the down-slope of some stretches of these roads fall into steep ravines. This steep terrain extends beyond the Town's border, down into the towns of Egremont and Copake. Winter conditions can make these roads dangerous to travel, particularly for emergency vehicles that may not be equipped to handle snowy, icy conditions.

#### **Built Environment**

Severe winter storms can damage the built environment by collapsing roofs under the weight of snow, making roads impassable due to snow or ice, damaging roads by freezing or unintended damage due to snowplows, freezing and bursting pipes, downing trees and power lines, and the flooding damages that result from melting snow. Utility power line systems are especially vulnerable due to heavy snows and high winds that can accompany severe winter storms. In Mount Washington, maintaining safe travel along East Street and the Falls Road is critical to connecting residents to key services (shops, fuel, doctors and hospitals, schools, etc.).

#### **Natural environment**

Winter storms are a natural part of the Massachusetts climate, and native ecosystems and species are well adapted to these events. However, changes in the frequency or severity of winter storms could increase their environmental impacts. Environmental impacts of severe winter storms can include direct mortality of individual plants and animals and felling of trees, the latter of which can alter the physical structure of the ecosystem. These impacts can include direct damage to species and ecosystems, habitat destruction, and the distribution of contaminants and hazardous materials throughout the environment (MEMA & EOEEA, 2018).

#### **Economy**

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain municipal and state financial resources due to the cost of staff overtime, snow removal and wear on equipment. Although severe winter events can impact municipal and commercial activity, these economic impacts are less severe in Mount Washington because the economy is linked most directly to facilities that operate in the non-winter seasons (Camp High Rock and state forests). The Town's broadband system allows an increasing number of residents to work from home during winter storms where travel conditions are unsafe or when schools and businesses are closed.

Seasonal homeowners are becoming full-time residents. The COVID-19 pandemic has temporarily accelerated this rate. Many of them are not accustomed to driving in severe winter conditions or during mud season, and the demand to pave dirt roads may become more intense as this housing trend continues. This may have long-term cost implications to the Town.

For Mount Washington, the Ice Storm of 2008 was the most damaging and widespread in recent memory. Regionally, FEMA obligated more than \$32 million to Massachusetts, state-related costs totaled more than \$7 million, and municipal costs in the state totaled more than \$5 million. National Grid claimed damages of more than \$30 million across its territory. According to the state *Climate Action Plan*, small businesses without electricity across the state lost "tens of millions of dollars." In Mount Washington, these impacts did not impact the economy and instead required a few days of volunteer and Highway tree removal.

Severe winter weather can lead to flooding in low-lying agricultural areas. Ice that accumulates on branches in orchards and forests can cause branches to break, while the combination of ice and wind can fell trees. These damages can stress trees and reduce the quality of the trees in forests that are being managed for timber (MEMA & EOEEA, 2018).

#### **Future Conditions**

Although no one storm can be completely linked directly to climate change, the severity of rain and snow events has increased dramatically in recent years. The amount of precipitation released by storms in the Northeast has increased by 55 percent from the baseline level (recorded from 1901 to 1960) and present-day levels (measured from 2001 to 2016). Winter precipitation is predicted to more often be in the form of heavy wet snow, ice or rain rather than the fluffier snow that had been more typical for the region. The transition to wetter snow, rain and ice formation has implications for how roads and utility line infrastructure will be maintained.



# Hurricanes/Tropical Storms

#### Hazard Profile

#### **Likely Severity**

Tropical cyclones (tropical depressions, tropical storms, and hurricanes) form over the warm, moist waters of the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico:

- A tropical depression is declared when there is a low-pressure center in the tropics with sustained winds of 25 to 33 mph.
- A tropical storm (T.S.) is a named event defined as having sustained winds from 34 to 73 mph.
- A hurricane is a storm with sustained winds reach 74 mph or greater. The hurricanes are categorized based on sustained winds; wind gusts associated with hurricanes may exceed the sustained winds and cause more severe localized damage.

When water temperatures are at least 80°F, hurricanes can grow and thrive, generating enormous amounts of energy, which is released in the form of numerous thunderstorms, flooding, rainfall, and very damaging winds. The damaging winds help create a dangerous storm surge in which the water rises above the normal astronomical tide. In the lower latitudes, hurricanes tend to move from east to west. However, when a storm drifts further north, the westerly flow at the mid-latitudes tends to cause the storm to curve toward the north and east. When this occurs, the storm may accelerate its forward speed. This is one of the reasons why some of the strongest hurricanes of record have reached New England (MEMA & EOEEA, 2018).

The severity of a hurricane is categorized by the Saffir-Simpson Hurricane Scale. This scale ranks hurricanes based on sustained wind speeds—from Category 1 (74 - 95 mph, minimal intensity) to Category 5 (156 mph or more, catastrophic intensity). All winds are using the U.S. 1-minute average, meaning the highest wind that is sustained for one minute (MEMA, 2013). The Saffir/Simpson Scale described in Table 3.6. gives an overview of the wind speeds and range of damage caused by different hurricane categories. Category 3, 4, and 5 hurricanes are considered "major" hurricanes, where devastating and catastrophic damage will occur. The Commonwealth has not been impacted by any Category 4 or 5 hurricanes; however, Category 3 storms have historically caused widespread flooding. In Berkshire County flooding tends to be the impact of greatest concern because hurricane-force winds here occur less often.

Historical data show that most tropical storms and hurricanes that hit landfall in New England are seldom of hurricane force, and of those most are a Category 1 or 2 hurricanes. The category hurricanes that stand out are those from 1938, and 1954 (BRPC, 2012), and those resulted in devastating flooding. T. S. Irene in 2011 was the most destructive tropical storm in recent decades.

Table 3.6. Saffir/Simpson Scale

Scale No. (Category)	Winds (mph)	Potential Damage
Tropical Depression	< 38	NA
Tropical Storm	39-73	NA
1	74-95	Minimal: Damage is primarily to shrubbery and trees, mobile homes, and some signs. No real damage is done to structures.
2	96-110	Moderate: Some trees topple, some roof coverings are damaged, and major damage is done to mobile homes.
3	111-130	Extensive: Large trees topple, some structural damage is done to roofs, mobile homes are destroyed, and structural damage is done to small homes and utility buildings.
4	131-155	Extreme: Extensive damage is done to roofs, windows, and doors: roof systems on small buildings completely fail; and some curtain walls fail.
5	>155	Catastrophic: Roof damage is considerable and widespread, window and door damage is severe, there are extensive glass failures, and entire buildings could fail.

Source: BRPC, 2012.

#### **Probability**

Based on past reported hurricane and tropical storm data, the region can expect a tropical depression, storm or hurricane to cross the region every 14.5 years. However, the community may also be impacted by a tropical event whose path is outside of the region every 0.75 years. Based on past storm events and given that the center of the county is approximately 85 miles to the Long Island Sound and 115 miles to Boston Harbor, the Berkshires will continue to be impacted by hurricanes and tropical storms. The recurrence rate will likely increase due to rising ocean temperatures due to climate change.

The NOAA Hurricane Research Division published a map showing the chance that a tropical storm or hurricane (of any intensity) will affect a given area during the hurricane season (June to November). This analysis was based on historical data from 1944 to 1999. Based on this analysis, the community has a 20-40% chance of a tropical storm or hurricane affecting the area each year (MEMA, 2013). The official hurricane season runs from June 1 to November 30. In New England, these storms are most likely to occur in August, September, and the first half of October. This is due in large part to the fact that it takes a considerable amount of time for the waters south of Long Island to warm to the temperature necessary to sustain the storms this far north. Also, as the region progresses into the fall months, the upper-level jet stream has more dips, meaning that the steering winds might flow from the Great Lakes southward to the Gulf States and then back northward up the eastern seaboard. This pattern would be conducive for capturing a tropical system over the Bahamas and accelerating it northward.

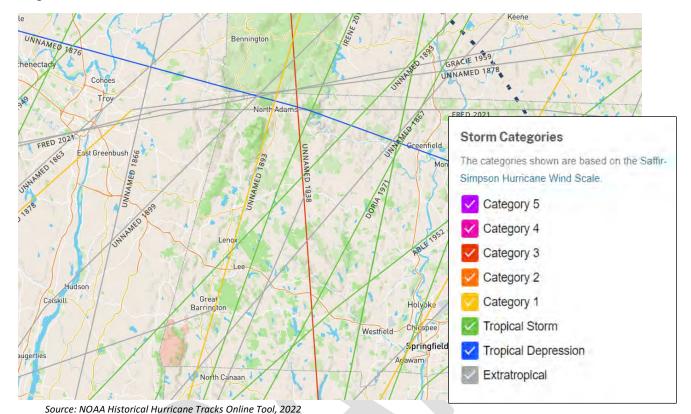


Figure 3.4: Historical Hurricane Paths within 65 miles of Massachusetts

#### **Geographic Areas Likely Impacted**

The entire Town of Mount Washington is vulnerable to hurricanes and tropical storms, depending on each storm's track. Inland areas, especially those in floodplains, near waterways, or isolated in the hills and mountains are at risk for flooding from heavy rain and wind damage. The majority of the damage following hurricanes and tropical storms often results from residual wind damage and inland flooding, as was demonstrated during recent tropical storms. Historic storm tracks can be seen in the NOAA graphic, Figure 3.4. The graphic shows tropical storm tracks that have traveled through Massachusetts, where H = Hurricane, TS = Tropical Storm, and TD = Tropical Depression.

#### **Historic Data**

The National Oceanic and Atmospheric Administration (NOAA) has been keeping records of hurricanes since 1842. From 1842 to 2018, there have been several tropical storms that passed directly through Berkshire County (see Figure 3.4 and Table 3.6). Although high winds are always of concern, it is the heavy rains and associated flooding that historically have caused the most injuries, deaths and damage in the Berkshire County region.

The Great Hurricane of 1938 remains one of the most memorable historic storms, with almost seven inches of rain falling over a three-day period. In the Berkshires, two deaths occurred, many other people were injured, and 300 people were left homeless.

Table 3.7. Tropical Depressions, Storms and Hurricanes Impacting Berkshire County

Name	Category	Date
Not Named	Tropical Depression	8/17/1867
Unnamed	Tropical Storm	9/19/1876
Unnamed	Tropical Depression	10/24/1878
Unnamed	Category 1 Hurricane	8/24/1893
Unnamed	Tropical Storm	8/29/1893
Unnamed	Tropical Depression	11/1/1899
Unnamed	Tropical Depression	9/30/1924
Unnamed	Category 2 Hurricane	9/21/1938
Able	Tropical Storm	9/1/1952
Gracie	Tropical Depression	10/1/1959
Doria	Tropical Storm	8/28/1971
Irene	Tropical Storm	8/28/2011

Source: NOAA, MEMA & EOEEA, 2018.

Hurricane Gloria caused extensive damage along the east coast of the U.S. and heavy rains and flooding in western Massachusetts in 1985. This event resulted in a federal disaster declaration (FEMA DR-751). In October 2005 the remnants of Tropical Storm Tammy followed by a subtropical depression produced significant rain and flooding across western Massachusetts. It was reported that between 9 and 11 inches of rain fell. The heavy rainfall washed out many roads in Hampshire and Franklin Counties andthe Green River flooded a mobile home park in Greenfield, with at least 70 people left homeless. This series of storms resulted in a federal disaster declaration (FEMA DR-1614) and Massachusetts received over \$13 million in individual and public assistance. (MEMA, 2013)

Tropical Storm Irene (August 27-29, 2011) produced significant amounts of rain, storm surge, inland and coastal flooding, and wind damage across southern New England and much of the east coast of the U.S. These heavy rains caused flooding throughout the Commonwealth and a presidential disaster was declared (FEMA DR-4028). The Commonwealth received over \$31 million in individual and public assistance from FEMA. (MEMA, 2013)

Regionally, T.S. Irene (DR-4028-MA) is the most memorable storm event in recent history due to the flooding that occurred in northern Berkshire and Franklin Counties in Massachusetts, and in southern Vermont. It caused flood levels equal to or greater than a 100-year flood event in Williamstown and North Adams. Extensive flooding in the Deerfield River watershed caused, among other damages, the closing of Route 2 in Florida/Charlemont (due to collapse of the road and a landslide). Immediately after this even the USGS recorded flood levels and recalculated and red-delineated the boundaries for the 100-year floodplain for the Hoosic River as it flows through portions of North Adams and Williamstown. This is one of the very few areas in Berkshire County where floodplain maps have been updated since the 1980s.

In Mount Washington, T.S. Irene caused damages to roads across the Town. Washouts were so severe on the dirt road section of southern East Street that it had to be closed completely, isolating a few homes. The Falls Road was so severely damaged that it was in imminent risk of collapse. This road was

closed for over a year while the Town procured engineering design and secured funding to repair the damage. The Town was finally successful in obtaining a STRAP grant to help fund construction. Culverts washed out along East Road and several long driveways and private roads were washed out, cutting residents off from emergency services.

The other storm that caused extensive damage in Mount Washington was that of T.S. Sandy in 2012. The high winds that accompanied this storm downed trees and electricity lines across the Town. Crews of local residents worked together with chainsaws to help the highway department re-open roads.

# **Vulnerability Assessment**

#### People

It is believed that the only fatalities that occurred due to tropical storms in Berkshire County was during the hurricane of 1938, and those were from flooding, not high winds. High winds from tropical storms and hurricanes can knock down trees, limbs and electric lines, can damage buildings, and send debris flying, leading to injury or loss of life. Economically distressed, elderly and other vulnerable populations are most susceptible, based on several factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Findings reveal that human behavior contributes to flood fatality occurrences, and this was seen during flooding of The Spruces in Williamstown when some residents only left their homes when forcibly removed by emergency personnel. Populations that live or work in proximity to facilities that use or store toxic substances are at greater risk of exposure to these substances during a flood event such as near the railroad tracks, town garage, or transfer station.

The most vulnerable include people with low socioeconomic status, people over the age of 65, people with medical needs, and those with low English language fluency. For example, people with low socioeconomic status are likely to consider the economic impacts of evacuation when deciding whether to evacuate. During and after an event, rescue workers and utility workers are vulnerable to impacts from high water, swift currents, rescues, and submerged debris. Vulnerable populations may also be less likely to have adequate resources to recover from the loss of their homes and jobs or to relocate from a damaged neighborhood (MEMA & EOEEA, 2018).

#### **Built Environment**

Hurricanes and tropical storms can destroy homes with wind, flooding, or even fire that results from the destructive forces of the storm. Critical facilities are mostly impacted during a hurricane by flooding, and these impacts are discussed in the flooding section of this plan. Wind-related damages from downed trees, limbs, electricity lines and communications systems would be at risk during high winds. Local and state-owned police and fire stations, other public safety buildings, and facilities that serve as emergency operation centers may experience direct loss (damage) during a hurricane or tropical storm. Emergency responders may also be exposed to hazardous situations when responding to calls. Road blockages caused by downed trees may impair travel. Heavy rains can lead to contamination of well water and can release contaminants from septic systems (DPH, 2014 as cited in MEMA & EOEEA, 2018). Additionally, hurricanes and tropical storms often result in power outages and contact with damaged power lines during and after a storm, which may result in electrocution.

Several residential, commercial and industrial buildings were destroyed during the floods of 1938, 1949 and 1955 in northern Berkshire County during tropical storm events. Most recently the full destruction and permanent removal of all homes in The Spruces mobile home park in Williamstown demonstrates the vulnerability of structures due to hurricane-related flooding.

#### **Natural Environment**

The environmental impacts of hurricanes and tropical storms are similar to those described for other hazards, including inland flooding, severe winter storms and other severe weather events. As the storm is occurring, flooding may disrupt normal ecosystem function and wind may fell trees and other vegetation. Additionally, wind-borne or waterborne detritus can cause mortality to animals if they are struck or transported to a non-suitable habitat. In the longer term, impacts to natural resources and the environment as a result of hurricanes and tropical storms are generally related to changes in the physical structure of ecosystems. For example, flooding may cause scour in riverbeds, modifying the river ecosystem and depositing the scoured sediment in another location. Similarly, trees that fall during the storm may represent lost habitat for local species, or they may decompose and provide nutrients for the growth of new vegetation. Invasive aquatic species and floodplain species such as knotweed are readily dispersed when plant fragments are transported by floodwaters. If the storm spreads pollutants into natural ecosystems, contamination can disrupt food and water supplies, causing widespread and long-term population impacts on species in the area.

### **Economy**

Hurricane/tropical storm events can greatly impact the economy, including loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings. Due to the wind and water damage, and transportation issues that result, the impact to the economy can potentially be very high. The Commonwealth received over \$31 million in individual and public assistance from FEMA during presidential disaster declared (FEMA DR4028) for T.S. Irene in 2011 (MEMA & EOEEA, 2018). Regional storm impacts are discussed in more detail in the Inland Flooding section of this plan.

# **Future conditions**

The Northeast has been experiencing more frequent days with temperatures above 90°F, increasing sea surface temperatures and sea levels, changes in precipitation patterns and amounts, and alterations in hydrological patterns. According to the Massachusetts Climate Change Adaptation Report, large storm events are becoming more frequent. Although there is still some level of uncertainty, research indicates the warming climate may double the frequency of Category 4 and 5 hurricanes by the end of the century and decrease the frequency of less severe hurricane events. The 2020 Atlantic hurricane season closed with a record-breaking 30 named storms and 12 landfalling storms in the continental United States. This is the fifth consecutive year with an above-normal Atlantic hurricane season, with 18 above-normal seasons out of the past 26. This increased hurricane activity is attributed to the warm phase of the Atlantic Multi-Decadal Oscillation — which began in 1995 — and has favored more, stronger, and longer-lasting storms since that time. Such active eras for Atlantic hurricanes have historically lasted about 25 to 40 years. <sup>7</sup>

<sup>7</sup> NOAA, at https://www.noaa.gov/media-release/record-breaking-atlantic-hurricane-season-draws-to-end

# Inland Flooding, including Dam Impacts

# Hazard Profile

Inland flooding is the result of moderate precipitation over several days, intense precipitation over a short period, or melting snowpack (U.S. Climate Resilience Toolkit, 2017). Common types of local or regional flooding are categorized as inland flooding including riverine, ground failures, ice jams, dam overtopping or failure, beaver activity (tree removal, dam construction, and dam failure), levee failure, and urban drainage. Overbank flooding occurs when water in rivers and streams flows into the surrounding floodplain or into "any area of land susceptible to being inundated by floodwaters from any source." (FEMA, 2011 as cited in MEMA & EOEEA, 2018<sup>8</sup>). The hazards that produce these flooding events in the Berkshire County region include spring melt, hurricanes, tropical storms, heavy rain events, winter rain-on-snow, thunderstorms, and recovering beaver populations. This Inland Flooding section will focus on flood impacts due to severe precipitation events that result in impacts approaching the 100-year event or caused significant damages, and on potential dam failure risk. Hurricanes/tropical storms, winter-related flooding and thunderstorms are discussed in other sections of this plan.

# Likely severity

In general, the severity level of flood damage is affected by flood depth and flood velocity. The deeper and faster flood flows become, the more power they have to carry heavy debris, erode banks and cause damage. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This is especially true when a channel migrates over a broad floodplain, redirecting high velocity flows and transporting debris and sediment. (MEMA, 2013) However, flood damage to homes and buildings can occur even during shallow, low velocity flows that inundate the structure, its mechanical system and furnishings.

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. The 100-year flood elevation or discharge of a stream or river has a 1% chance of occurring or being exceeded in any given year. In this case the statistical recurrence interval would be 100 years between the storm events that meet the 100-year discharge/flow. Increases in precipitation and extreme storm events will result in increased inland flooding.

A dam is an artificial barrier that has the ability to impound water for the purpose of storage or flood control. There are six dams in Mount Washington that have the potential to cause damage if they were to fail in some way. These are listed in Table 3.8 and their locations are shown on the Critical Facilities Map (Figure 3.2). Size class may be determined by either volume of water stored or height, whichever gives the larger size classification. Small impoundments store between 15-50 acre-feet and Intermediate impoundments store 50-1,000 acre-feet. An acre-foot is defined as enough water to cover one acre of land one foot deep, which equals slightly less than 326,000 gallons.

The Hazard Potential Classification rating pertains to potential loss of human life or property damage in the event of failure or improper operation of the dam or appurtenant works. Low Hazard dams are

<sup>&</sup>lt;sup>8</sup> MA MEMA & EOEEA, 2018 <u>https://www.mass.gov/service-details/massachusetts-integrated-state-hazard-mitigation-and-climate-adaptation-plan</u>

those that are defined as being located where failure or mis-operation may cause minimal property damage to others, and loss of life is not expected. Significant dams are defined as being located where failure or mis-operation may cause loss of life and damage home(s), industrial or commercial facilities, secondary highway(s) or railroad(s) or cause interruption of use or service of relatively important facilities. There are no High Hazard dams in Mount Washington.<sup>9</sup>

Probable future development of the area downstream from the dam that would be affected by its failure shall be considered in determining the classification. Even dams which, theoretically, would pose little threat under normal circumstances can overspill or fail under the stress of a cataclysmic event such as an earthquake or sabotage. Dam owners are legally responsible for having their dams inspected on a regular basis.

Table 3.8. Dams that could impact Mount Washington

Name and Year Completed	Hazard Code	Size Class (Max. acrefeet storage)	Inspection Condition & Date	Owner
Van Der Smissen Pond, 1940	Low	Non-jurisdictional (1)	1999, Good	First Agricultural Bank
Guilder Pond, 1900	Low	Non-jurisdictional (55)	2009, Satisfactory	Private
Hunt Pond, 1929	Low	Small (65)	1999, Fair	MA DCR
Plantain Pond, 1849	Significant	Intermediate (350)	2017, Fair	The Nature Conservancy
Becker Pond, 1920	Low	Small (6)	2016, Poor	The Nature Conservancy
Garrett Dam (West Lee Pond), 1964*	Low	Small (60)	1999, Fair	GF Nash LLC

Source: Office of Dam Safety, 2004. Or USGS, 2018. Or Citizen Times Dam Safety Inspection. Becker Pond Dam source: BSC Group, 2021, SEIR for Becker Pond Dam Removal. Note: Some records may be out of date if procured by Office of Dam Safety in 2004. \*Garrett Dam is not included on Critical Facilities Map

#### **Probability**

The extent of the area of flooding associated with a 1% annual probability of occurrence (the base flood or 100-year flood), most commonly termed the 100-year floodplain area, is a tool for assessing vulnerability and risk in flood-prone communities. Such a storm, with a 1% chance of occurrence, is commonly called the 100-year storm. Similarly, the 50-year storm has a statistical recurrence interval of 50 years and an "annual flood" is the greatest flood event expected to occur in a typical year. It should be understood, however, that these measurements reflect statistical averages only; it is possible for two or more floods with a 100-year flood discharge to occur in a short time period. The 100-year flood boundary is used as the regulatory boundary by many agencies, including FEMA and MEMA. It is also the boundary used for most municipalities when regulating development within flood-prone areas. A structure located within a the 100-year floodplain on the NFIP maps has on average a 26% percent

<sup>&</sup>lt;sup>9</sup> https://www.mass.gov/files/documents/2017/10/30/302cmr10.pdf

chance of suffering flood damage during the term of a 30-year mortgage (MEMA, 2013). NFIP maps have never been devloped for the Town of Mount Washington.

Due to steep slopes and minimal soil cover, hilltowns such as Mount Washington are particularly susceptible to flash flooding caused by rapid runoff that occurs during heavy precipitation in combination with spring snowmelt. These conditions contribute to riverine flooding. Frozen ground conditions can also contribute to low rainfall infiltration and high runoff events that may result in riverine flooding (MEMA, 2018). Berkshire County has frozen ground conditions for more of the year than most

Table 3.9: Recurrence Intervals and Probabilities of Occurrences

Recurrence interval, in years	Probability of occurrence in any given year	Percent chance occurrence in any given year
500	1 in 500	0.2
100	1 in 100	1
50	1 in 50	2
25	1 in 25	4
10	1 in 10	10
5	1 in 5	20
2	1 in 2	50

of Massachusetts, and Mount Washington has frozen ground longer than its neighboring towns of Egremont and Sheffield. In the county there is a 90% likelihood that the temperature will reach 28° by October 22<sup>nd</sup>, with the potential ground freezing conditions lasting until May 20<sup>th</sup> of the following year (NOAA, 1988 as cited by UMASS Extension accessed on March 12<sup>th</sup>, 2019).

Factors that contribute to dam failure include design flaw, age, over-capacity stress and lack of maintenance. There are two primary types of dam failure: catastrophic failure, characterized by the sudden, rapid, and uncontrolled release of impounded water, or design failure, which occurs as a result of minor overflow events. Dam overtopping is caused by floods that exceed the capacity of the dam, and it can occur as a result of inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors. Overtopping accounts for 34% of all dam failures in the U.S. (BRPC, 2012). In Massachusetts the Office of Dam Safety, within the DCR, is the regulating authority that oversees dam safety.

By state law, dam owners are legally responsible for maintaining their dams, inspecting them on a regular basis and liable for damages and loss of life that occur as a result of a dam failure. Significant Hazard dams must be inspected every five years and Low Hazard dams must be inspected every 10 years. Owners of Significant Hazard dams are strongly encouraged, but not required, to develop Emergency Action Plans. This Plan would include a notification flow chart, list of response personnel and their responsibilities, a map of the inundation area that would be impacted, and a procedure for warning and evacuating local residents in the inundation area. The EAP would be filed with local and state emergency agencies.

The Town of Mount Washington does not have reliable data on the condition of five of the dams in Town nor information on when they were last inspected. The data reported herein is from outdated Office of Dam Safety and USGS databases that has not been comprehensively updated since 2018. The Town does have recent dam condition data on the Becker Pond dam from a report conducted in 2016 which found this dam to be in poor condition. The Nature Conservancy, the dam's owner, is currently in the design and permitting process to remove the dam in an effort to improve aquatic connectivity and reduce risk of damage or failure.

#### **Historical Data**

There have been dozens of severe precipitation events that caused flooding in the Berkshire County region, the more severe of which are listed with a brief description in Table 3.9. Between 1938 and 2017, four flood events equaling or exceeding the 1% annual chance flood have been documented the Berkshire County region, those being in 1938, 1949, 1955 and 2011. These four events are bolded in Table 3.9. Not all these events were documented to a 1% chance storm for the region around Mount Washington. For example, Tropical Storm (T.S.) Irene in 2011 was determined to be a 1% chance flood event in northern Berkshire County and a 2% chance storm (50-year recurrence) in central and southern Berkshire County (using data from the USGS Housatonic River stream gage in Pittsfield).

Flash flooding from the October 2005 severe rain event damaged a road culvert on Mountain Road, a private road constructed on steeply sloped terrain. The culvert was improperly designed and installed and was not able to handle the flows created during the storm. Six homes were isolated for a few days until emergency repairs with a larger culvert could be done.

Figure 3.6: Bank erosion of Bash Bish River and damage to Falls Road four days after T.S. Irene



Source: Brian Tobin, Mt. Washington EMD, 2011.

Figure 3.5: Road washout of East Street during T.S. Irene



Source: Brian Tobin, Mt. Washington EMD, 2011.

During T.S. Irene in 2011 the Falls Road was damaged to the point that it was threatened with collapsing into the brook. The road was closed to traffic for approximately one year while the Town pursued funding for repairs, ultimately securing STRAP grant funding. The cost to repair 1,000 feet of this road was approximately \$1 million. The southern portion of East Street had to be closed due to damage, isolating a few homes that had to travel through Connecticut for a short time. T.S. Lee followed on the heels of T.S. Irene, adding localized flooding to already-damaged roads and culverts.

Table 3.10. Previous Flooding Occurrences in the Berkshire County Region

Year	Description of Event			
1936	Widespread flooding occurs along the northern Atlantic in March 1936. Widespread loss of life and infrastructure.			
1938	"The Great Hurricane of 1938" was considered a 1% annual chance flood event in several. The Hoosic River flooded downtown areas of North Adams, with loss of life and extensive damage to buildings.			
Dec. 31, 1948 - Jan. 1, 1949	The New Year's Flood hit North Adams severely wiping out buildings along the Hoosic River and with many of areas registering the flood as a 1% annual chance flood event.			
1955	Hurricanes Connie and Diane combined to flood many of the communities in the region and registering in 1% - 0.2% annual chance flood event (100-500-year flood event) (FEMA 1977-1991).			
May 1984	A multi-day storm left up to 9" of rain throughout the region and 20" of rain in localized areas. This was reported as an 80-year flood for most of the area and higher where the rainfall was greater (USGS, 1989).			
Sept. 1999	The remnants from Hurricane Floyd brought between 2.5-5" of rain and produced significant flooding throughout the region. Due to significant amounts of rain and the accompanying wind, there were numerous reports of trees down.			
Dec. 2000	A complex storm system brought 2-4" of rain with some areas receiving an inch an hour. The region had numerous reports of flooding			
Mar. 2003	An area of low pressure brought 1-2" of rain, however this and the unseasonable temperatures caused a rapid melting of the snowpack.			
Aug. 2003	Isolated thunderstorms developed that were slow moving and prolific rainmakers. Flooding led to the evacuation of Berkshire residents.			
Sept. 2004	The remnants from Hurricane Ivan brought 3-6" of rain. This, combined with previously saturated soils, caused flooding throughout the region.			
Oct. 2005	A stationary cold front brought over 6" of rain and caused widespread flooding throughout the region.			
Nov. 2005	Widespread rainfall across the region of 1-1.5", which was preceded by 1-2 feet of snow, resulted in widespread minor flooding.			
Sept. 2007	Moderate to heavy rainfall occurred, which lead to localized flooding.			
Mar. 2008	Heavy rainfall ranging from 1-3" impact the area. Combined with frozen ground and snowmelt, this led to flooding across the region.			
Aug. 2008	A storm brought very heavy rainfall and resulted in flash flooding across parts of the region.			
Dec. 2008	A storm brought 1-4" of rain to the region, with some areas reporting $\frac{1}{4}$ to $\frac{1}{3}$ of an inch an hour of freezing rain, before changing to snow. Moderate flooding and ponding occurred throughout the region.			
June 2009	Numerous slow-moving thunderstorms developed across the region with intense rainfalls and up to 6" of hail. This led to flash flooding in the region.			
July 2009	Thunderstorms across the region caused heavy rainfall and flash flooding.			
Aug. 2009	An upper-level disturbance moved across the region during the afternoon hours and triggered isolated thunderstorms causing road flooding.			
Oct. 2009	A low-pressure system moved across region bringing a widespread heavy rainfall to the area; 2-3" of rain was reported across the region.			

Mar.	Heavy rainfall of 1.5-3" across the region closed roads due to flooding.		
2010			
Oct. 2010	The remnants from Tropical Storm Nicole brought 50-60 mph winds and 4-6" of rain resulting in urban flooding.		
Mar. 2011	Heavy rainfall combined with runoff from snowmelt due to mild temperatures resulted in flooding of waterways, roads, and basements.		
July 2011	Scattered strong to severe thunderstorms spread across the region resulting in small stream and urban flooding.		
Aug. 2011	Two distinct rounds of thunderstorms occurred producing heavy rainfall and localized flooding of roads.		
Aug. 2011	T.S. Irene tracked over the region with widespread flooding and damaging winds. Riverine and flash flooding resulted from 3-9 inches of rain within a 12-hour period. Widespread road closures occurred throughout the region. In MA his event was a 1% annual chance flood event in the Hoosic River Watershe and a 50-year event in the Housatonic River Watershed.		
Sept. 2011	Remnants of Tropical Storm Lee brought 4-9" of heavy rainfall to the region. Due to the saturated soils from T.S. Irene, this rainfall led to widespread flooding on rivers as well as small streams.		
Aug. 2012	Remnants from Hurricane Sandy brought thunderstorms repeatedly bringing heavy rains over the region. Upwards of 4-5" of rain occurred and flash flooding caused the closure of numerous roads.		
May 2013	Thunderstorms brought wind and heavy rainfall caused flash flooding and road closures in areas.		
Aug. 2013	Heavy rainfall repeatedly moved across the region with more than 3 inches of rain in just a few hours. Streams and creeks overflowed causing flash flooding. Roads were closed and water rushed into some basements.		
Sept. 2013	Showers and thunderstorms tracked over region and resulted in persistent heavy rain, flash flooding and road closures.		
June 2014	Slow moving showers and thunderstorms developed producing very heavy rain over a short period of time. This led to some flash flooding and road closers, especially in urban and poor drainage areas.		
June 2014	Showers and thunderstorms repeatedly passed over the same locations with heavy rainfall and significant runoff, causing flash flooding in some areas. Many roads were closed and some homes were affected.		
July 2014	A cluster of strong to severe thunderstorms broke out causing heavy rainfall and flash flooding with 3-6" of rainfall occurring.		
May 2016	Bands of slow-moving showers and thunderstorms broke out over the region. Heavy rainfall repeatedly fell over the area resulting in flash flooding and some roads were temporarily closed.		
Aug. 2017	Widespread rain moved through the area resulting in isolated flash flooding.		

Source: BRPC 2018 (unless otherwise noted)

According to the data and local officials and residents, the more notable flood events that occurred in Mount Washington were the October 2005 rain event, T.S. Irene in 2011 and T.S. Sandy in 2012. According to local officials, to their knowledge there has never been a dam failure in Mount Washington. Historically, dam failure has had a low occurrence in Berkshire County. There have been two dam failures in East Lee, from dams that impounded the same pond. On April 20, 1886 the Basin Pond dam breached and flooded East Lee, killing seven people and damaging almost every house along the Basin Pond Brook corridor on Water and Cape Streets. In 1965 a developer constructed a new dam at Basin Pond, and that one breached in March 1968, killing one person and damaging buildings along

the brook corridor. The floodwaters damaged the Clarke Aiken paper mill to the point where it was demolished and the site abandoned, causing the loss of a key local employer.

# **Vulnerability Assessment**

# Geographic areas likely impacted

Although there are undoubtedly floodplain areas within Mount Washington, no floodplain studies or flood insurance rate maps have been developed for any portion of the Town. Therefore, no floodplain maps accompany this plan. The areas that have been identified as being of concern due to flooding are shown on the Critical Facilities and Areas of Concern map (Figure 3.2).

There are relatively few roads in Mount Washington, but a few roadways are key because there are few detours that can reroute traffic and maintain emergency routes. The key areas of flooding area shown on the map in Figure 3.2, where causes of flooding tend to be from severe precipitation events, undersized culverts and beaver activity. The areas of most concern are along East Street, one of two main travel routes within the Town and also the main access route to services outside of Town.

Many culverts have been identified as being overwhelmed during storm events. The culvert at the Cattle Shed has been identified is of main concern, again because it is located on the northern portion of East Street, the main access road to outside services.

Many sections of gravel roads experience washouts and drainage damages due to heavy precipitation events, particularly East Street, Hatch Hill Road, West Street, Plaintain Pond Road, and Old Plaintain Pond Road. The privately-owned road to Camp Hi-Rock can be difficult to traverse due to water damage.

Figure 3.7: Road washout and water damage on Old Plaintain Rd.

Because of the hilly terrain, homes have been constructed upgradient of roads and often have long steep gravel driveways. Many of these driveways were constructed without means to control runoff, and thus become pathways for erosive high-water flows ladened with sediment. Driveway runoff accelerates flood damages to gravel roads, increasing sediment transport into local streams.

Street Name: Plantain Pond Road | Segment ID: 02 | Gravel Road Score: 3

Source:BETA Mt. Washington Gravel Roads Study, 2020

The Department of Conservation & Recreation maintains the road systems within its various properties in Mount Washington. These roads also suffer damages during severe storm events, and occasionally the roads have had to be closed for repairs.

Beavers are part of the natural landscape, and by damming streams create they create wetlands and open water habitats that support a more complex and biodiverse ecosystem. Wetland systems can provide flood storage capacities and reduce flashy flood conditions when beaver dams are intact. However, expansion of water levels upgradient of the dams can flood residential properties and impact the quality of drinking water sources and the functionality of septic systems. In these instances, risk to human health may require action to control water levels. In many instances installing water leveler devices in beaver dams to allow continued water flow or structures that to bar beavers from clogging culverts alleviates flooding problems. Grants from the Human Society have helped to fund several such projects across the Berkshires. Where such methods do not solve the problem, removal of the beaver population must be undertaken, although this has become more difficult as trappers is the region have become less common.

A few key areas on the southern portion of East Street experience flooding due to beaver activities. The property owner of West Lee Pond has installed a Beaver Deceiver device on their property to maintain water flow and control water levels to reduce flooding at the site.

#### People

The impact of flooding on life, health, and safety is dependent upon several factors, including the severity of the event and whether or not adequate warning time is provided to residents. Populations living in or near unmapped floodplain areas may be impacted during a flood event. At this time FIRM floodplain boundaries have not been delineated for the Town of Mount Washington, so there is no guidance for steering future development away from floodplain area. The Massachusetts Wetlands Protection Act provides some protection for wetland resources, requiring that development be conducted outside wetland and riverfront areas. Where development does occur within these areas, wetland mitigation can be required, including flood storage replication.

The total number of injuries and casualties resulting from typical riverine flooding is generally limited due to advance weather forecasting, blockades, and warnings. The historical record from 1993 to 2017 indicates that there have been two fatalities in in Massachusetts associated with flooding, both in Topsfield during the Mother's Day Flood of 2006, and five injuries associated with two flood events, occurring within two weeks of each other in March 2010. While six inches of moving water can cause adults to fall, 1 foot to 2 feet of water can sweep cars away. Downed powerlines, sharp objects in the water, or fast-moving debris that may be moving in or near the water all present an immediate danger to individuals in the flood zone. Events that cause loss of electricity and flooding in basements, which are where heating systems are typically located in Massachusetts homes, increase the risk of carbon monoxide poisoning. Carbon monoxide results from improper location and operation of cooking and heating devices (grills, stoves), damaged chimneys, or generators.

Finally, the growth of mold inside buildings is often widespread after a flood. Investigations following Hurricane Katrina and Superstorm Sandy found mold in the walls of many water-damaged homes and buildings. Mold can result in allergic reactions and can exacerbate existing respiratory diseases, including asthma (CDC, 2004). Property damage and displacement of homes and businesses can lead to loss of livelihood and long-term mental stress for those facing relocation. Individuals may develop post-traumatic stress, anxiety, and depression following major flooding events (Neria et al., 2008 as cited in MEMA & EOEEA, 2018)

People and property downstream of dams may be at risk from dam failures. Because all the dams in Mount Washington are relatively small in scale, the owners of these structures are not required by law to develop Emergency Action Plans (EAPs) or delineate the potential dam failure inundation area. Even the Town's largest dam, that of Plantain Pond, is not large enough that the owner is required to develop an EAP. Therefore, the Town does not have data on the number of people who are at risk due to dam failure or the severity of the damages that may result from dam failures.

#### **Built Environment**

Mount Washington does not have its floodplains delineated by a FIRM. As such, the Town is not a NFIP community. 44 CFR § 201.6(c)(2)(ii) requires that all hazard mitigation plans approved after October 1, 2008 must address NFIP insured structures that have been repetitively damaged by floods. Because the Town is not a NFIP community, there are no properties that are eligible for NFIP insurance, and therefore there are no documented repetitive flood loss properties in Mount Washington. Finally, because there are no delineated FIRM floodplain boundaries, it is not possible to identify and quantify potential building damages or losses due to a 100-year flood event.

Regarding dam failures, all structures, critical facilities and roadways in the inundation zone are vulnerable to damage. Flood waters may potentially cut off evacuation routes, limit emergency access, and destroy power lines and communication infrastructure.

Flood waters can increase the risk of the creation of and dislodging of ice dams during the winter months. Blocks of ice can develop in streams and rivers to create a physical barrier or dam that restricts flow, causing water to back up and overflow its banks. Large ice jam blocks that break away and flow downstream can damage culverts, bridges and roadways whose openings are too small to allow passage (MEMA, 2013).

Electrical power outages can occur during flood storm events, particularly when storm events are accompanied by high winds, such as during hurricanes, tropical storms, thunderstorms and microbursts. Fortunately, most flooding in the Berkshire region is localized and have resulted in few widespread outages in recent years, and where it occurs service has typically been restored within a few hours. A severe flood event can threaten the functionality or structural integrity of the dams that are overtopped or fail.

Landslides on steep slopes can occur when soils are saturated and give way to sloughing, often dislodging trees and boulders that were bound by the soil. The damage from T.S. Irene in 2011 to Route 2 in the Florida/Charlemont area was a combination of fluvial erosion from the Cold and Deerfield Rivers and a landslide on the upland slope of the road.

Flooding of homes and businesses can impact human safety health if the area of inundation is not properly dried and restored. Wood framing can rot if not properly dried, compromising building structure and strength. Undetected populations of mold can establish and proliferate in carpets, duct work, wall board and almost any surface that is not properly dried and cleaned. Repeated inundation brings increased risks of both structural damage and mold.

#### **Natural Environment**

Flooding and saturated soils has the potential to affect the natural environment in several ways. Septic systems can flood, contaminating the surrounding areas, posing health risks, and damaging the

environment. Flooding can spread chemical and bacterial contamination potentially harmful to people, the environment, and wildlife.

Flooding can remove trees, other vegetation, rocks and soil causing erosion, high turbidity and the loss of community assets. Excessive sedimentation of stream and lake beds can disrupt aquatic life cycles by smothering aquatic life and fish eggs. Sedimentation of lakes and ponds can create the shallower, warmer shoreline conditions that favor infestation of invasive aquatic plants such as Phragmites, purple loosestrife, Eurasian water milfoil, water chestnut and a host of others. Invasive species can be carried downstream and dispersed into new areas in flood waters, particularly those like Japanese knotweed that readily spreads via broken plant fragments.

Stormwater drainage systems collect contaminants and sediment from roads and other surfaces and transports it into waterways if there is not a sufficient buffer to filter out the contaminants and sediment. Typically, there is no infrastructure in place to protect from nonpoint source pollution of this type.

The sudden and potentially extreme volumes of water released during dam failures can result in ecological damage both upstream and downstream of the dam. River channels downstream of the dam can experience severe scouring, banks can experience erosion and mass wasting, and boulders can become dislodged and move downstream. Trees and other vegetation can become uprooted and add to the debris moved by floodwaters, potentially clogging and threatening the integrity of culverts and bridges. Upstream of the dam the former impoundment could become partially or completely dewatered, altering, and potentially destroying lacustrine aquatic habitat (MEMA, 2013.)

#### **Economy**

The impacts of flooding on the economy include the value of buildings and businesses potentially lost during a flood event, the loss of business revenue during the response and recovery period, economic loss due to an inability to commute to work or communicate, and the burden of paying for recovery and the rebuilding of infrastructure. In Mount Washington preserving the full function of the two main roads that provide egress into the Town is key to providing access to the few businesses that are located here, particularly during the summer months. The largest impact would be to YMCA's Camp Hi-Rock YMCA. As a non-profit Camp Hi-Rock doesn't pay taxes to the town, but they would suffer substantially without access to campgrounds.

#### **Future Conditions**

Based on data gathered from the Northeast Climate Science Center (NECSC), the yearly precipitation total for Berkshire County has been experiencing a gradual rise over the last 70 years, rising from 40.1 inches in the 1960's to 48.6 inches in the 2000's. According to projections from the NECSC, the county is projected to experience an additional 3.55 inches by the 2050's and 4.72 inches by the 2090's. (Northeast Climate Science Center, 2018)

The scientific community agrees that climate change is altering the weather and precipitation patterns of the northeastern region of the U.S. The Intergovernmental Panel on Climate Change report of 2007 predicts temperature increases ranging from 2.5-5.0° C (36-41° F) over the next 100 years across the U.S., with the greatest increase in the northern states and during the winter months. More mid-winter cold/thaw weather pattern events could increase the risk of ice jams. Many studies agree that warmer

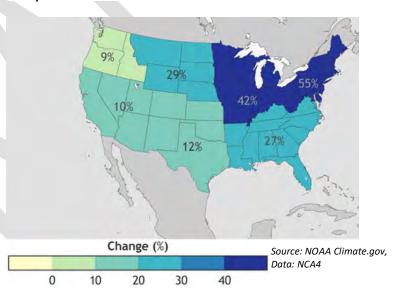
temperatures late in the will result in more rain-on-snow storm events, leading to higher spring melt flows, which typically are already the highest flows of the year.

Studies have also reported increases in precipitation in both developed and undeveloped watersheds across the northeast, with the increases being observed over a range of precipitation intensities, particularly in categories characterized as heavy and extreme storm events. These events are expected to increase both in number and in magnitude. Some scientists predict that the recurrence interval for extreme storm and flood events will be significantly reduced. One study concluded that the 10-year storm may more realistically have a recurrence interval of 6 years, a 25-year storm may have a recurrence interval of 14 years and the 100-year storm may have a recurrence interval of 49-years. The same study predicts that if historic trends continue that flood magnitudes will increase, on average, by almost 17% (Walter & Vogel, 2010).

Data from USGS streamflow gages across the northeast show a clear increase in flow since 1940, with an indication that a sharp "stepped" increase occurred in the 1970s. This is despite the fact that much of the land within many New England watershed has been reforested, and this type of land cover change would tend to reduce, rather than increase, flood peaks (Collins, 2008).

NOAA has documented that extreme or heavy precipitation events have grown more frequent since the start of the twentieth century, and such events are likely to become even more frequent over the twenty-first. Heavy precipitation is defined by NOAA as those heavy rain or snow events ranking among the top 1 percent (99th percentile) of daily events, has increased 55% in the Northeast between 1958-2012. 10 It should be noted that during this period, a nine-year drought from 1961-1969, the drought of record for this region, occurred during this period. As such, this may underestimate the overall trend for future projections.

Figure 3.8. Increase in Precipitation Falling in Top 1% Extreme Precipitation Events 1958-2016



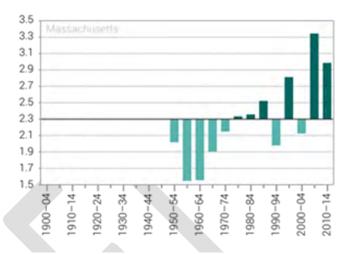
The Massachusetts Climate Change Projections report looked at the precipitation changes expected by greenhouse gas effects within the state's major watersheds. According to an upper-level scenario, the days per year with precipitation of more than one inch in the Housatonic River Watershed is predicted to increase from the baseline of six days per year to nine days by the 2050s, and to 10 days by the 2090s. The baseline reflects precipitation data 1971-2000. The upper scenario represents a 47% increase in these storms from the baseline by mid-century and a 66% increase by end of century.

https://www.climate.gov/news-features/featured-images/prepare-more-downpours-heavy-rain-has-increased-across-most-united-0

Summer is currently season when there is the greatest chance for extreme precipitation events to occur, and summer is projected to continue to be the season of greatest chance and the season with the greatest increases in the number of days with extreme precipitation. Already observed in Massachusetts, the number of extreme precipitation events, those defined as more than two inches in one day, has increased since the the 1980s, with the greastest increase in the past decade (see Figure 3.8)<sup>11</sup>.

This trend has direct implications on the design of municipal infrastructure that can withstand extreme storm and flood events, indicating that all future designs must be based on the most updated precipitation and stream gauge information available. Due to the increase in the

Figure 3.9. Number of Extreme Precipitation Events of 2" or more in 1 Day



Source: https://statesummaries.ncics.org/ma

summer population due to second homeowners, Camp Hi-Rock and the state forests, maintaining functioning roads is critical for travel and emergency access.

It may be prudent, therefore, to slightly overdesign the size of new stormwater management and flood control systems so that they have the capacity to accept the increase in flow or volume without failing. For many piped systems, such as culverts, drainage ditches and swales, the slight increase in size may provide a large increase in capacity, and for very little increase in cost. If space is available, an increase in the capacity of retention/detention ponds may also be cost effective. Bioretention cells can be engineered so that they can increase their holding capacity for extreme storm events with little incremental cost. The size of the engineered soil media, which is a costly component of the system, may remain the same size as current designs call for, but a surface ponding area surrounding the central soil media is increased to serve as a holding pond.

If climate change results in a greater number of severe precipitation events and shortens recurrence intervals them, as is predicted, it will require dam operators to become more vigilant in monitoring precipitation and temperature patterns. Individual rain events, particularly if occurring during periods of saturated or frozen soils that cannot absorb rainfall, may require that dam operators open spillways, flashboards and other safety features more often, causing a greater number of high discharge events and possible flooding on properties downstream of the dam. Although climate change may not increase the probability of catastrophic dam failure, it may increase the probability of design failures that were based on outdated precipitation patterns (MEMA, 2013).

<sup>&</sup>lt;sup>11</sup> https://statesummaries.ncics.org/ma

# Tornadoes, High Winds and Thunderstorms

# **Hazard Profile**

## **Likely Severity**

Tornadoes are potentially the most dangerous of local storms. If a major tornado were to strike damage could be significant, particularly if there is a home or other facility in its path. Many people could be displaced for an extended period of time; buildings could be damaged or destroyed; businesses could be forced to close for an extended period of time or even permanently; and routine services, such as telephone or power, could be disrupted.

The NWS rates tornadoes using the Enhanced Fujita scale (EF scale), which does not directly measure wind speed but rather the amount of damage created. This scale derives 3-second gusts estimated at the point of damage based on the assignment of 1 out of 8 degrees of damage to a range of different structure types. These estimates vary with height and exposure.

High winds and thunderstorms occur outside of notable storm events, but still can cause significant damages. Mount Washington, like other Berkshire County communities, has experienced numerous thunderstorms and high wind events including microbursts. Wind is air in motion relative to the surface of the earth. A thunderstorm is a storm originating in a cumulonimbus cloud. Cumulonimbus clouds produce lightning, which locally heats the air to 50,000 degrees Celsius, which in turn produces an audible shock wave, known as thunder. Frequently during thunderstorm events, heavy rain and gusty winds are present. Less frequently, hail is present, which can become very large in size. Tornadoes can also be generated during these events (MEMA & EOEEA, 2018).

Effects from high winds can include downed trees and/or power lines and damage to roofs, windows, and other structural components. High winds can cause scattered power outages. Massachusetts is susceptible to high winds from several types of weather events: before and after frontal systems, hurricanes and tropical storms, severe thunderstorms and tornadoes, and nor'easters. Sometimes, wind gusts of only 40 to 45 mph can cause scattered power outages from downed trees and wires. This is especially true after periods of prolonged drought or excessive rainfall, since both are situations that can weaken the root systems and make them more susceptible to the winds' effects. Winds measuring less than 30 mph are not considered to be hazardous under most circumstances.

A thunderstorm is classified as "severe" when it produces damaging wind gusts in excess of 58 mph, hail that is one inch in diameter or larger (quarter size), or a tornado (NWS, 2013). The severity of thunderstorms can vary widely, from commonplace and short-term events to large-scale storms that result in direct damage and flooding. Widespread flooding is the most common characteristic that leads to a storm being declared a disaster. The severity of flooding varies widely based both on characteristics of the storm itself and the region in which it occurs. Lightning can occasionally also present a severe hazard (MEMA & EOEEA, 2018).

### **Probability**

The location of tornado impact is totally unpredictable. Tornadoes are fierce phenomena which generate wind funnels of up to 200 MPH or more, and occur in Massachusetts usually during June, July, and August, although the county's most devastating was in Great Barrington in May. From 1950 to 2017, the Commonwealth experienced 171 tornadoes, or an average annual occurrence of 2.6 tornado events per year. In the last 20 years, the average frequency of these events has been 1.7 events per year (NOAA, 2018). Massachusetts experienced an average of 1.4 tornadoes per 10,000 square feet annually between 1991 and 2010, less than half of the national average of 3.5 tornadoes per 10,000 square feet per year (NOAA, n.d. as cited in MEMA & EOEEA, 2018).

According to the National Climatic Data Center, since 1950, there have been 13 tornados that have touched down or moved in a path across Berkshire County, and there are several others that occurred in adjacent counties and states in the region. The most recent of these was in July 2014 when a tornado struck in Dalton. This averages to

Figure 3.10. Density of Reported Tornadoes per Square Mile

Source: MEMA, 2018, from NOAA Storm Prediction Center (SPC)

one tornado striking the county approximately every five years. Of these, only two have been of a severity of an EF4, which indicates that such a severe tornado has a statistical recurrence rate of one in every 33 years. (NOAA, 2017).

North American Datum 1983

Over a ten-year period (January 1, 2008 through December 31, 2017), a total of 435 high wind events occurred in Massachusetts for an annual average of 43.5 events occurred per year. High winds are defined by NWS as sustained non-convective winds of 35 knots or greater (~40 mph) or lasting for one hour or longer, or gusts of 50 knots or greater (58 mph) for any duration (NCDC, 2018). However, many of these events may have occurred as a result of the same weather system, so this count may overestimate the frequency of this hazard. The probability of future high wind events is expected to increase as a result of climate projections for the state that suggest a greater occurrence of severe weather events in the future.

Three basic components are required for a thunderstorm to form: moisture, rising unstable air, and a lifting mechanism. The sun heats the surface of the earth, which warms the air above it. If this warm surface air is forced to rise—by hills or mountains, or areas where warm/cold or wet/dry air bump together causing a rising motion—it will continue to rise as long as it weighs less and stays warmer than the air around it. As the warm surface air rises, it transfers heat from the surface of the earth to the

upper levels of the atmosphere (the process of convection). The water vapor it contains begins to cool, releasing the heat, and the vapor condenses into a cloud. The cloud eventually grows upward into areas where the temperature is below freezing. Some of the water vapor turns to ice, and some of it turns into water droplets. Both have electrical charges. When a sufficient charge builds up, the energy is discharged in a bolt of lightning, which causes the sound waves we hear as thunder. An average thunderstorm is 15 miles across and lasts 30 minutes; severe thunderstorms can be much larger and longer. Southern New England typically experiences 10 to 15 days per year with severe thunderstorms (MEMA & EOEEA, 2018). Lightning strikes primarily occur during the summer months. According to NOAA, there has been one fatality and 43 injuries as a result of lightning events from 1993 and 2012 in the Commonwealth (NCDC, 2012). Although thunderstorms with lightening may increase due to a more volatile atmosphere, the chance of death or injury is likely to remain low.

### **Geographic Areas Likely Impacted**

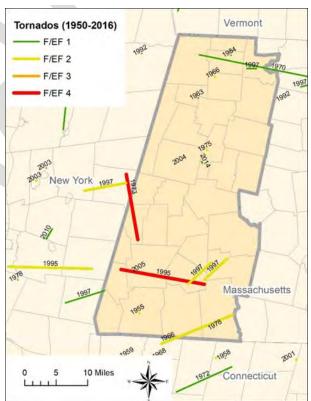
All of Mount Washington is vulnerable to tornados, high winds and thunderstorms that can cause extensive damage. Microbursts can also occur anywhere associated with thunderstorms.

#### **Historic Data**

The National Climatic Data Center reports data on tornado events and does so as far back as 1950. Of the 18 tornados that have occurred in Berkshire County between 1950 and 2018, only one has occurred since 2007, an EF1 in July 2014 in Dalton. Four tornados occurred during a single storm on July 3, 1997. These have resulted in over \$29 million in damage, seven deaths, and 60+ injuries. (NOAA, 2017). The most memorable tornados in recent history occurred in West Stockbridge in August of 1973 (category F4) and in Great Barrington, Egremont, and Monterey in May of 1995 (category F4). In the West Stockbridge tornado four people died and 36 were injured, and in Great Barrington three people died and 24 were injured (MEMA & EOEEA, 2018). The signs of the tornado's destruction are still visible today in Great Barrington from Rt. 7. The hill to the east is scarred where the tornado uprooted and toppled trees.

High wind events occasionally impact the Town of Mount Washington and require emergency response. In 2012 the winds that accompanied T.S. Sandy required response all across the Town. Local officials and private residents worked together with chainsaws and heavy equipment to open roads for utility crews and help neighbors open driveways.

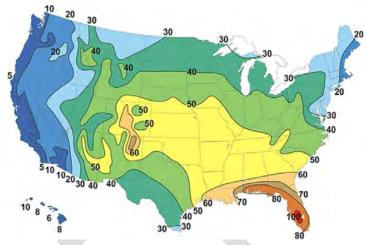
Figure 3.11. Tornados in the Berkshire Region and their Severity



Source: Midwest Regional Climate Center, 2018.

It is difficult to define the number of other severe weather events experienced by Mount Washington each year. Figure 3.23 shows number of annual thunderstorm days across the United States. According to a map created by NOAA and NWS, and featured in the SHMCAP, Western Massachusetts experiences approximately 30 thunderstorm days each year. An average thunderstorm is 15 miles across and lasts 30 minutes, although severe thunderstorms can be much larger and longer (MEMA, 2013).

Figure 3.12. Annual Avg. Number of Thunderstorm Days in U.S.



Source: NOAA NWS, MEMA & EOEEA, 2018.

## Microbursts occur throughout

Berkshire County, downing trees, utility lines and sometimes causing damage to property. In the Berkshires microbursts are often accompanied by heavy rainfall that can cause additional damage from flooding. According to news media reports, several recent thunderstorm/microburst events have caused damages in the communities of Williamstown, North Adams, Cheshire, Lanesborough, Pittsfield, Lee, and Stockbridge. Figure \_\_ show microburst damage in Cheshire, Berkshire County, in 2016.

An event that struck Pittsfield and other central Berkshire communities in July 2011 caused extensive damage and was responsible for the death of a man in Hinsdale who was struck by a falling utility pole. WMECO called in 339 out-of-state work electric crews and 14 out-of-state tree crews to remove trees and repair damaged lines. 12

On Sunday, June 1, 2016 an afternoon thunderstorm stalled for two hours over Lee and Stockbridge, flooding streets, basements and ground floors, including the ground floor of Stockbridge Town Hall.

Figure 3.13. Microburst damage in Cheshire, 7-18-16



Source: iBerkshires 2011.

Stockbridge received almost 5" of rain while 4.5" fell at the Lee water treatment plant. Another inch of rain fell the next evening in another storm. 13

<sup>&</sup>lt;sup>12</sup> McKeever, Andy, 1-27-11. "Pittsfield Slammed by Surprise Microburst Storm," iBerkshires.

<sup>&</sup>lt;sup>13</sup> Lindsay, Dick, 6-1-16. "Weekend deluge swamps roads, homes in Stockbridge, Lee," Berkshire Eagle.

# **Vulnerability Assessment**

## **People**

The entire population of Mount Washington is considered exposed to tornado, high-wind and thunderstorm events. Downed trees, damaged buildings, and debris carried by high winds can lead to injury or loss of life. Individuals with limited communication capacity, such as those with limited internet or phone access, may not be aware of impending tornado or microburst warnings. The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible. This short warning time is part of why tornados are so dangerous. Tornado watches and warnings are issued by the local NWS office. A tornado watch is released when tornadoes are possible in an area. A tornado warning means a tornado has been sighted or indicated by weather radar. (MEMA, 2018).

In Mount Washington, warning systems are broadcast over television stations via satellite TV companies or via local or regional radio stations. The Town is located within the Albany satellite market, so its news and weather forecasts comes from local stations based in Albany, NY. Weather apps are available to download onto smart phones and tablets, but it is unknown how many residents subscribe to such apps. The Town's Emergency Planner monitors the weather and issues alerts and warning to residents signed up for Blackboard Connect. To date 113 of the 165 (nearly 70%) are signed up for this service. In addition, a phone tree list is collected and organized by Council on Aging as well as the Town Clerk.

The most common problem associated with severe weather is loss of utilities. Severe windstorms causing downed trees can create serious impacts on electricity and aboveground communication lines. Downed power lines can cause blackouts, leaving large areas isolated. Loss of electricity and phone connections would leave certain populations isolated because residents would be unable to call for assistance. Additionally, the loss of power can impact heating or cooling systems and cause loss of electricity to power oxygen and other life-sustaining equipment. Downed wires can create the risk of fire, electrocution, or an explosion. People who work or engage in recreation outdoors are also vulnerable to severe weather, including downed live wires or lighting strikes.

Socially vulnerable populations are most susceptible to severe weather based on a number of factors, including their physical and financial ability to react or respond during a hazard, and the location and construction quality of their housing. In general, vulnerable populations include people over the age of 65, the elderly living alone, people with low socioeconomic status, people with low English language fluency, people with limited mobility or a life- threatening illness, and people who lack transportation or are living in areas that are isolated from major roads. The isolation of these populations is a significant concern. Power outages may also result in inappropriate use of combustion heaters, cooking appliances and generators in indoor or poorly ventilated areas, leading to increased risks of carbon monoxide poisoning.

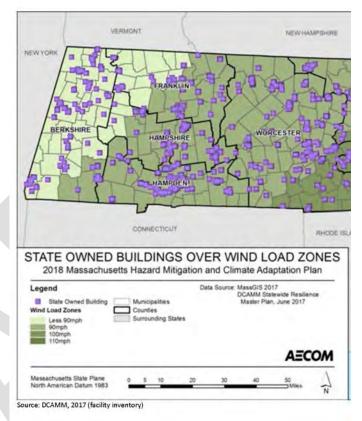
All of these severe wind events present potential safety impacts for individuals without access to shelter during these events. Additionally, research has found that thunderstorms may cause the rate of emergency room visits for asthma to increase to 5 to 10 times the normal rate. Much of this phenomenon is attributed to the stress and anxiety that many individuals, particularly children, experience during severe thunderstorms. The combination of wind, rain, and lightning from thunderstorms with pollen and mold spores can exacerbate asthma (MEMA & EOEEA, 2018).

#### **Built Environment**

All elements of the built environment are exposed to severe weather events such as tornoados, high winds and thunderstorms. Damage to buildings is dependent upon several factors, including wind speed, storm duration, path of the storm track, and building construction. The state is divided into four risk categories, the limits of which are defined by the Massachusetts State Building Code (9th Ed.). National wind data prepared by the American Society of Civil Engineers serve as the basis of these wind design. Generally speaking, structures should be designed to withstand the total wind load of their location. Massachusetts used these load zone determinations to determine risk to state facilities from wind hazards, and this map shows that Mount Washington is located in the lowest load zone set at less than 90 mph (see Figure 3.23).

Public safety facilities and equipment may experience a direct loss (damage) from high winds. Roads may become impassable due to flash flooding, or due to landslides caused by heavy, prolonged rains. Impacts to transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting) transportation needs. Water and sewer systems may not function if power is lost. The hail, wind,

Figure 3.14. Wind Load Zones for Massachusetts According to MA State Building Code



Source: MEMA & EOEEA, 2018.

debris, and flash flooding associated with tornadoes can cause damage to infrastructure (MEMA & EOEEA, 2018).

#### **Natural Environment**

As described under other hazards, such as hurricanes and nor'easters, high wind events can defoliate forest canopies and cause structural changes within an ecosystem that can destabilize food webs and cause widespread repercussions. Direct impacts may occur to flora and fauna small enough to be uprooted and transported by the tornado. Even if the winds are not sufficient to transport trees and other large plants, they may still uproot them, causing significant damage to the surrounding habitat. As felled trees decompose, the increased dry matter may increase the threat of wildfire in vegetated areas. Additionally, the loss of root systems increases the potential for soil erosion. Disturbances created by blowdown events may also impact the biodiversity and composition of the forest ecosystem. Invasive plant species are often able to quickly capitalize on the resources (such as sunlight) available in disturbed and damaged ecosystems. This enables them to gain a foothold and establish quickly with less competition from native species. In addition to damaging existing ecosystems, material transported by tornadoes can also cause environmental havoc in surrounding areas. Particular challenges are presented

by the possibility of asbestos-contaminated building materials or other hazardous waste being transported to natural areas or bodies of water, which could then become contaminated

# Economy

Tornado events are typically localized; however, in those areas, economic impacts can be significant. High winds and thunderstorms impacts may be less severe but cover a larger area, so they can also impact the local economy. Forestry species and agricultural crops, equipment, and infrastructure may be directly impacted by tornadoes. Types of impacts may include loss of business functions, water supply system damage, damage to inventories, relocation costs, wage losses, and rental losses due to the repair or replacement of buildings. Recovery and clean-up costs can also be costly. The damage inflicted by historical tornadoes in Massachusetts varies widely, but the average damage per event is approximately \$3.9 million (MEMA, 2018).

According to the NOAA's Technical Paper on Lightning Fatalities, Injuries, and Damage Reports in the U.S. from 1959 to 1994, monetary losses for lightning events range from less than \$50 to greater than \$5 million (the larger losses are associated with forest fires, with homes destroyed, and with crop loss) (NOAA, 1997). Lightning can be responsible for damage to buildings; can cause electrical, forest and/or wildfires; and can damage infrastructure, such as power transmission lines and communication towers (MEMA & EOEEA, 2018).

#### **Future Conditions**

Tornado activity in the U.S. has become more variable, and increasingly so in the last two decades. While the number of days per year that tornadoes occur has decreased, the number of tornadoes on these days has increased. Climate models show projections that the frequency and intensity of severe thunderstorms (which include tornadoes, hail, and winds) will increase (USGCRP, 2017 as cited in MEMA & EOEEA, 2018). The short warning time combined with the lack of a public warning system that could be widely transmitted to households in Mount Washington increases the risk of people to tornadoes.

Research into the impact of climate change on severe storms such as thunderstorms has looked at the impact of the increased convective available potential energy (CAPE) on frequency and intensity of storms, and a decrease in wind shear as the Artic warms. Some studies show no change in the number of storms, but an increase in intensity due to more energy and evaporated moisture available to fuel storms. Other studies have shown an increase in the number and intensity of storms because the increase in CAPE compensated for a decrease in wind shear<sup>14</sup>. We can expect greater impacts of severe storms in the region while the exact changes are still being determined. Educating residents to be prepared emergency situations where loss of electricity occurs and maintaining an emergency communications system that can be used to reach isolated residents during power outages will become more important, especially to meet the needs of an increasingly elderly population.

56

<sup>&</sup>lt;sup>14</sup> https://earthobservatory.nasa.gov/features/ClimateStorms

# Drought

# Hazard Profile

Drought is a period characterized by long durations of below normal precipitation. Direct impacts of drought include reduced water supply, crop yield, increased fire hazard, reduced water levels, and damage to wildlife and fish habitat.

The Massachusetts Office of Energy and Environmental Affairs (EEA) and MEMA partnered to develop the *Massachusetts Drought Management Plan*, of which September 2019 is the most updated version. The state's Drought Management Task Force, comprised of state and federal agencies, was created to assist in monitoring, coordinating and managing responses to droughts and recommends action to minimize impacts to public health, safety, the environment and agriculture (EEA, MEMA, 2019). The Massachusetts Department of Conservation & Recreation (DCR) staff compile data from the agencies and develop monthly reports to track and summarize current water resource conditions.

In Massachusetts, the determination of drought level is based on seven indices: Standardized Precipitation Index, Crop Moisture Index, Keetch-Byram Drought Index, Precipitation, Groundwater levels, Streamflow levels, and Index Reservoir levels. Determinations regarding the end of a drought or reduction of the drought level focus on two key drought indicators: precipitation and groundwater levels. These two factors have the greatest long-term impact on streamflow, water supply, reservoir levels, soil moisture and potential for forest fires. Precipitation is a key factor because it is the overall cause of improving conditions. Groundwater levels respond slowly to improving conditions, so they are good indicators of long-term recovery to normal conditions.

# Likely severity

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. Droughts are not usually associated with immediate impacts on people or property, but they can have significant impacts on agriculture, which can impact the farming community of the region. As noted in the state Hazard Mitigation Plan, agriculture-related drought disasters are quite common, with 50-66% of the counties in the U.S. having been designated as disaster areas in each of the past several years. These designations make it possible for producers suffering losses to receive emergency loans. Such a disaster was declared in December 2010 for Berkshire County (USDA Designation # S3072).

For the purposes of the state *Drought Management Plan*, drought conditions are classified into five levels: 'Level 0-Normal' (i.e., No Drought), 'Level 1-Mild Drought' (formerly Advisory), 'Level 2-Significant Drought' (formerly Watch), 'Level 3-Critical Drought' (formerly Warning), and 'Level 4-Emergency Drought' (formerly Emergency). These levels were selected to provide distinction between different levels of drought severity and for adequate warning of worsening drought conditions (EEA & MEMA, 2019).

MassDEP has the authority to declare water emergencies for communities facing public health or safety threats as a result of the status of their water supply systems, whether caused by drought conditions or

for other reasons. The Department of Public Health in conjunction with the DEP monitors drinking water quality in communities.

## **Probability**

As described below, Berkshire County is generally at a lower risk of drought relative to the rest of the Commonwealth. However, that does not eliminate the hazard from potentially impacting the County and the Town of Mount Washington. The recorded historic patterns show near misses of severe drought conditions. Increases in temperature lead to faster evaporation of reservoirs, waterways, soils, and greater evapotranspiration rates in plants.

## **Geographic Areas Likely Impacted**

For the purposes of tracking drought conditions across the Commonwealth, the state has been divided into six regions, with the Western Region being made up of Berkshire County. Although a wide-spread event has not impacted the Town in recent memory, for the purposes of this plan, the entire Town of Mount Washington is considered at risk of drought. All residents get their water supplies through individual private wells, which makes it difficult for the Town to monitor groundwater supplies or depth across Mount Washington. Most residents have deep wells drilled into bedrock.

#### **Historic Data**

Massachusetts is relatively water-rich, with few documented drought occurrences. The most severe, state-wide droughts occurred in 1879-1883, 1908-1912, 1929-1932, 1939-1944, 1961-1969, 1980-1983, and 2016-2017. Several less-severe droughts occurred in 1999, 2001, 2002, 2007, 2008, 2010, 2014 and 2020. The nine-year drought from 1961-1969 is considered the drought of record. The longevity and severity of this drought forced public water suppliers to implement water-use restrictions, and numerous communities utilized emergency water supplies<sup>15</sup>.

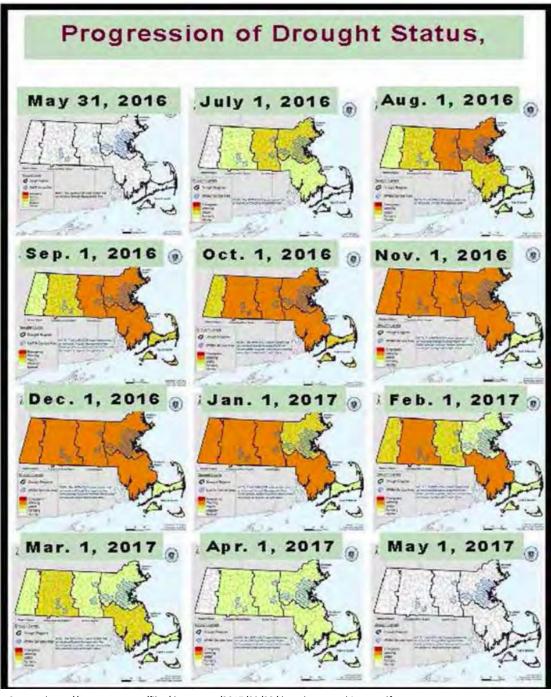
The Town of Mount Washington does not have any data regarding groundwater or private well water levels. Town officials are unaware of any residents whose wells have gone dry or were slow to recharge from use, except for a recollection that many years ago, possibly decades, a few wells failed. It is likely that there may be individuals whose wells are impaired but do not report the issue to the Town. During the public survey conducted by the Town as part of this planning process, only one of the 30 respondents stated that their well had ever run dry, and that was many years ago. One resident who participated in the MVP Workshop process reported that her 80-foot-deep well had a "hiccup" several years ago, but otherwise has provided steady and reliable water.

The most recent and significant drought in Massachusetts since the 1960s occurred during a 10-month span in 2016-17. In July 2016 Advisory and Watch drought levels began to be issued for the eastern and central portions of the state, worsening in severity until the entire state was under a Drought Warning status for the months of November-December 2016. In general, the central portion of the state faired the worse and Berkshire County faired the best, with the county entering the drought later and emerging from the drought earlier than most of the rest of the state. Berkshire County was under an Advisory (yellow on Figure 3.11) or Watch status (gold) for five months and under a Warning status (orange) for three months during the height of the drought. The Massachusetts Water Resources

 $<sup>^{15}\</sup> https://www.mass.gov/doc/massachusetts-drought-management-plan/download$ 

Commission stated that the drought was the worst since the state's Drought Management Plan was first issued in 2001, and the most severe since the 1960s drought of record. Refer to Figure 3.11 for the progression of the drought across the state.

Figure 3.15. Progression of the 2016-17 Drought



Source: https://www.mass.gov/files/documents/2017/09/08/drought-status-history.pdf

<sup>&</sup>lt;sup>16</sup> MA Water Resources Commission, 2017. Annual Report, Fiscal Year 2017. Boston, MA.

# **Vulnerability Assessment**

# **People**

The entire population of Mount Washington is exposed and vulnerable to drought. There is no public drinking water supply system in the Town; all drinking water is supplied through private wells, including Camp Hi-Rock. In general, those with shallow or low-yield drinking water wells are at higher risk than those with deeper wells. Residents and stakeholders who depend on water for their means of income, such as farmers and camp owners, could also be significantly impacted by a severe or prolonged drought. The Berkshire region has not suffered a severe, emergency level drought since the 1960s, and it is unclear how well the Town would fair during a prolonged drought given changes in population, water use, and precipitation patterns.

Drought would reduce the capacity of local firefighting efforts, hampering control of wildfire. A more detailed discussion of wildfire and the Town's vulnerability is found in that section of the report.

#### **Built Environment**

Drought does not threaten the physical stability of critical facilities in the same manner as other hazards such as wind-based or flood-related events. However, if drought led to wildfire, structures and woodlots across Mount Washington would be at risk. Wildfire could also damage or destroy electrical and communication systems, including the Town's broadband internet services, which is the main communications system in the Town.

#### **Natural Environment**

The natural environment is at greatest risk due to drought. Drought can lead to low flow and low groundwater levels, threatening the continued flow of streams and rivers. The cold-water fishery streams, on which native brook trout and other cold-water species depend for survival, could become too dry to too warm to sustain them. Lower, shallower lake and pond waters force aquatic life to congregate in smaller water volumes with lower oxygen levels, leading to stress and fish kills. Lower soil moisture causes vegetated to become stressed or die, causing trees and other vegetation to drop leaves and forbs to die back. The lower moisture reduces the ability of soil organisms to break down accumulated plant and animal matter. This combination of greater build-up of dry matter on the forest floor increases the risk of wildfire. These drier conditions can lead to decreases in plant and animal populations that need moist conditions to survive. Benefits of such conditions can mean lower populations of insects that carry pathogens, such as mosquitoes and ticks.

#### **Economy**

The economic impacts of drought can be substantial, and would primarily affect the agriculture, recreation and tourism, forestry, and energy sectors. Increased injury or die-back of forest trees could occur, especially if they are already stressed by insect infestations and other factors, such as we see occurring in Mount Washington. This increases the devaluation of timber stands for private woodlot owners and for the state. Decreased values bring decreased stumpage fees to the Town when forest sites are logged.

Drier summers and intermittent droughts may strain irrigation water supplies, stress crops, and delay or cause harvest which may result in higher demand than can be locally supplied. This can increase importation of produce and drive up the price of food, leading to economic stress on a broader portion of the economy. There is one farm called Blueberry Hill farm. In addition, the neighboring communities of Egremont, Great Barrington and Sheffield still have working farms that are part of the regional economy and provide fresh local produce, meat and dairy products to local residents.

#### **Future Conditions**

Changes in winter temperatures will lead to less snowpack and more rain-on-snow events, leading to more surface runoff and less groundwater recharge, leading to less stream and river base flows. Higher temperatures in warmer seasons can more severely impact the reduced base flows due to higher rates of evaporation of moisture from soil and lower groundwater and surface water inputs. According to the state's Climate Change Adaptation Report, a continued high greenhouse-gas-emission scenario could result in a 75% increase in the occurrence of drought conditions lasting 1-3 months. Given that Mount Washington is 93% forested, the risk of wildfire during drought conditions is a concern.

# Invasive Species and Forest Pests

# Hazard Profile

The Town of Mount Washington chose to examine the hazard of both plant and animal invasive species. Invasive species are a widespread problem in Massachusetts and throughout the country. The damage rendered by invasive species can be significant. The Massachusetts Invasive Plant Advisory Group (MIPAG) defines invasive plants as non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing selfsustaining populations and becoming dominant and/or disruptive to those systems. MIPAG is a collaborative representing organizations and professionals concerned with the conservation of the Massachusetts landscape, is charged by EOEEA to provide recommendations to the Commonwealth to manage invasive species of plants. These species have biological traits that provide them with competitive advantages over native species, particularly because in a new habitat they are not restricted by the biological controls of their native habitat. As a result, these invasive species can monopolize natural communities, displacing many native species and causing widespread economic and environmental damage. Uncontrolled growth of invasive species can alter soils, increase erosion, and reduce habitat value for native wildlife. Early detection and rapid response are key components to successful invasive species control. To address this, Mount Washington has developed a task force to define the problem and extent of invasives harm and determine the best practicable management.

# **Likely Severity**

The damage rendered by invasive species is significant. Experts estimate that about 3 million acres within the U.S. (an area twice the size of Delaware) are lost each year to invasive plants (from Mass.gov "Invasive Plant Facts"). The massive scope of this hazard means that the entire Commonwealth experiences impacts from these species. Furthermore, the ability of invasive species to travel far distances (either via natural mechanisms or accidental human interference) allows these species to propagate rapidly over a large geographic area, both on land and in aquatic systems. Areas with high amounts of plant or animal life may be at higher risk of exposure to invasive species than less vegetated urban areas; however, invasive species can disrupt ecosystems of all kinds (MEMA & EEA, 2018). Because plant and animal life is so abundant throughout Mount Washington and the Berkshire region, the entire area is considered to be at high risk of invasive species infestation.

# **Probability**

Increased rates of global trade and travel have created many new pathways for the dispersion of exotic species. As a result, the frequency with which these threats have been introduced has increased significantly. Increased international trade in ornamental plants is particularly concerning because many of the invasive plants species in the U.S. were originally imported as ornamentals, although Massachusetts has established prohibition on the propagation and sale of many invasive plant species. Invasive species can also be spread by animals, people, equipment, and machines as they travel through the region's landscape and waterways. Hikers, mountain bikers, ATVs and boaters can unwittingly spread invasive species if they travel from an infested area to a non-infested areas. As outdoor recreational tourism continues to increase in the Berkshires, this risk will also increase.

Several natural hazards increase the risk of invasive species spreading beyond their current ranges. Many invasive plant species are readily uprooted, transported and/or distributed to new areas during flood events. Plant fragments and seeds from semi-aquatic and aquatic plants such as Japanese knotweed, purple loosestrife, common reed, water chestnut, Eurasian water milfoil and curly leaf pondweed are spread in this fashion. Berries and seeds from terrestrial invasive plants are also distributed in this way, particularly if they are found along river corridors or floodplain areas. Wind, ice storms, or poor forestry that fragment or open up the tree canopy of forested landscapes can damage or stress the remaining trees and create the temporary conditions that allow invasive species to take hold and suppress regeneration of native trees.

The same windstorm that damaged the tree canopy may be the mechanism by which dispersal of invasive plant seeds arrive in the damaged forest. Wildfires in the Berkshires are typically surface fires, burning forest duff and damaging/killing seedlings and ground forbs. The die-back of plants on the forest floor temporarily could open the way for invasive understory species to take hold, such as honeysuckles species, buckthorn species, bittersweet and hardy kiwi vine. The risk of invasive infestation increases if the burned area is in close proximity to (and particularly downwind of) existing invasive species populations and seed sources. Risk is further increased if hikers and mountain bikers track seeds or plant fragments from the infested area prior to traveling through the burned site.

The risk of forest pests is dependent on their life cycle, their ability to disperse and the abundance of their preferred food source. The emerald ash borer is a very capable flyer, allowing it to move easily through the Berkshire landscape that is well endowed with ash tree species. The woolly adelgid spreads through wind, mammal and bird spread particularly from March through July making it a threat to connected hemlock landscapes.

Risk of invasive aquatic and riparian species infestation from one riverine, pond and lake ecosystem to another is largely due to human activity, although transport and distribution by birds and mammals is also possible. Plant fragments and seeds, and aquatic animals, easily travel from one water body to another via kayak, canoes, boats and equipment, including waders.

#### **Geographic Areas Likely Impacted**

All of Mount Washington and the surrounding region is at risk of invasive species, including its lakes and ponds. Roadside ash trees are rapidly being infected and dying, increasing risk of limbs or trees falling onto adjacent properties or into the road and oncoming traffic. In the next year the tree warden is scheduled to remove 100 infected trees. Hemlock forests are

Gravel roads and culvert installations have become vectors for the spread of stiltgrass along roadsides. This is particularly bad through the main roads of East Street and West Street, making monitoring and maintenance of road drainage systems more difficult. The Nature Conservancy most recently mapped Stiltgrass occurrences on their properties in 2019 as seen in Figure 3.16.

Riparian invasive plant species such as phragmites are found within the wetlands that dominate the landscape especially in the southern end of East Street.

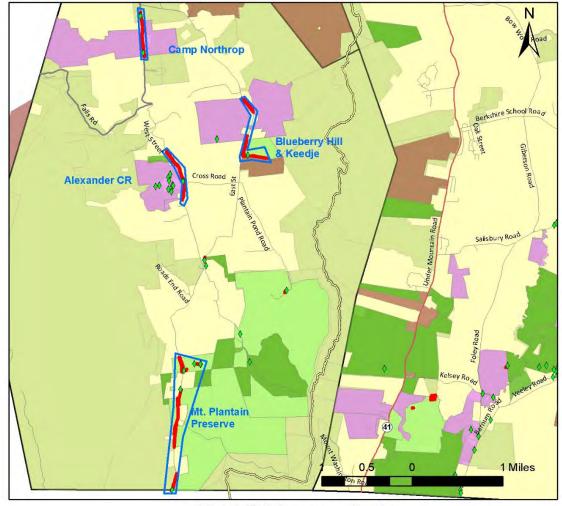
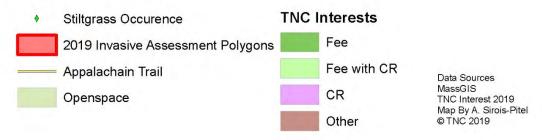


Figure 3.16. 2019 Stiltgrass Mapping on TNC Properties

# 2019 Stiltgrass Units Mt Washington, MA

# Legend



# **Historic Data**

Invasive species are a human-caused hazard, often resulting from release of foreign species brought into the country by the landscaping industry and pet trade. Invasive species are also inadvertently released when they escape from wood or produce products or from being unwittingly transported in shipping

containers. Because the presence of invasive species is ongoing rather than a series of discrete events, it is difficult to quantify the frequency of these occurrences.

Over the last decade, gypsy moth and winter moth have caused the most canopy damage in Massachusetts forests, totaling over 1.78 million acres. Hemlock woolly adelgid and emerald ash borer are now being seen extensively across the state, and a 110-square-mile area of central Massachusetts is regulated for the Asian longhorned beetle (ALB). In the fight to eradicate this non-native beetle, over 24,000 infested trees have been cut and chipped. Additionally, hundreds of acres of high-risk trees have been removed and destroyed to slow the spread of this invasive pest. 17

Addressing the issue of propagating and selling of invasive plants within the landscaping nursery industry began in the 1990s. MIPAG conducted field research to determine the most invasive plant species in the region, and in 2005 published its first list of plants designated as invasive or likely to be invasive in Massachusetts. Out of this list emerged a list of plants for which importation and propagation is currently prohibited within the state of Massachusetts. The sale, trade, purchase,

distribution and related activities for these species, including all cultivars, varieties and hybrids, are not allowed. The latest list, revised in 2017, includes 140 species. The full list can be viewed at this site: <a href="https://www.mass.gov/doc/prohibited-plant-list-sorted-by-common-name/download">https://www.mass.gov/doc/prohibited-plant-list-sorted-by-common-name/download</a>. Active links to details on each species is found on this site.

Invasive species of concern include, but are not limited to, phragmites, Canada thistle, garlic mustard, stilt grass, Japanese barberry, burning bush, hemlock woolly adelgid, beech scale, gypsy moth, emerald ash borer and Asian jumping earthworm. Perhaps most concerning is the hemlock woolly adelgid, a recent newcomer to Mount Washington via southern Connecticut forests along the Taconic Plateau.

Forests damage from insect and other pests can be extensive, and many of these are invasive species from other continents or other regions of the U.S. According to the 2020 Massachusetts State Forest Action Plan, the annual tree canopy damage from insects

Figure 3.17. Japanese stiltgrass found in Mount Washington



Source: inaturalist, March 2022

and diseases in Massachusetts ranged from 23,563 acres in 2012 to 939,051 acres in 2017. The average annual area of canopy damage was 201,681 acres (about 6% of total forest area) between 2009 and 2018. The three primary agents of canopy damage in total over that period were gypsy moth (1,481,115 acres), winter moth (300,571 acres), and weather events such as snow, ice, wind, tornado, frost, or hail (75,244 acres). Table 3.11 summarizes the most serious infestations facing Western Massachusetts forests.

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<sup>&</sup>lt;sup>17</sup> Mass DCR, 2020, Massachusetts State Forest Action Plan

Table 3.11. Current Invasive and Nuisance Insect Threats to Mount Washington Forests

Insect	Origin	Host Trees	DCR-Management Approach
Gypsy Moth	Introduced	Oaks, other deciduous species	Discovered in 1869, current management relies on natural population controls: naturally abundant virus and fungus populations regulate gypsy moth population cycles.
Winter Moth	Introduced	Maples, oaks, other deciduous trees (fruit)	Identified in state in 2003, it was introduced to Canada in the 1930s; a biocontrol species has been released and successfully established to manage populations in eastern MA.
Hemlock Woolly Adelgid	Introduced	Eastern hemlock	Discovered in 1989, two biocontrol species have been released in MA to limited establishment success.
Southern Pine Beetle	Native	Pitch pine	Population densities monitored through annual trapping; the impacts of climate change could significantly alter generation periods and devastate pitch pine stands.
Emerald Ash Borer	Introduced	All ash species	Discovered in 2012, three biocontrol species, were successfully released in MA; continued releases are planned.
White Pine Needlecast	Native	Eastern white pines	Needlecast has been identified to be caused by multiple fungal pathogens; white pine defoliation is being monitored across the state.
Red Pine Scale	Introduced	Red pine	Control with insecticides has not been successful and natural enemies are ineffective in reducing the population.

Sources: https://www.mass.gov/service-details/current-forest-health-threats; MA State Forest Action Plan 2020.

Hemlock woolly adelgid was introduced into Massachusetts in 1988 and attacks both Carolina and eastern hemlocks. Closely resembling an aphid, the hemlock woolly adelgid is a tiny insect covered with a woolly mass and looks like small white cotton balls at the base of the needles. It inserts its piercing/sucking mouthpart at the base of hemlock needles and can severely weaken and kill the hemlocks it feeds on. The cold, fluctuating winter temperatures we experience in Massachusetts cause woolly adelgid mortality that reduces the persistent feeding pressure.<sup>18</sup>

With rising temperatures, survival rates of some insect pests will increase, allowing them to expand their range. Woolly adelgid has been expanding northward, having crossed into the Housatonic River Valley from Connecticut in the early 2000s. Hemlocks are one of the four most common trees in Massachusetts and one of the top forest harvest products. Pines and hemlocks

Figure 3.18. Wooly adelgid found in Mount Washington



Source: Rod Parlee, NW Camp Committee, 2021

combined sequester around 80 million tons of carbon. In the Berkshires, hemlocks are valuable because they survive along steep ravines and help hold soil in place. Streams within hemlock forests have a greater diversity of aquatic invertebrates to support fish as compared to those within hardwood forests. Native brook trout are three times more likely to be found in streams surrounded by hemlock, which provide cooler water temperatures and more stable flows. This is of particular importance as Mount

<sup>&</sup>lt;sup>18</sup> Mass DCR, 2020, Massachusetts State Forest Action Plan

Washington boasts two of the state's Areas of Critical Environmental Concern, Karner Brook Watershed and Schenob Brook Drainage Basin.

# **Vulnerability Assessment**

## People

Invasive species can trigger a wide-ranging cascade of lost ecosystem services. Mount Washington provides clean drinking water through forested wellhead protection zones for Egremont, Sheffield and Great Barrington. As such the State has deemed Mount Washington to rank "very high" for enhanced public benefits from trees and forests. <sup>19</sup>

#### **Built Environment**

Mature roadside trees provide natural and cultural benefits to the community, creating the rural New England landscape that defines the region. Trees help to hold roadside soils in place and can act as windbreaks. Accelerated die-back of roadside trees can occur due to invasive pests such as the woolly adelgid or emerald ash borer, or stressed and pulled down by prolific invasive vines such as bittersweet. Damage and die-off of these trees present increased risk to homeowners who live in close proximity, to utility lines and to travelers who frequent the roads they are located on. Buildings are expected to be directly impacted by invasive species under circumstances similar to our roadways.

Roadways and roadside drainage areas are perhaps most acutely impacted by herbaceous invasives such as stiltgrass and phragmites in wetland areas. Both species tend to grow in thick mats and through compacted soil, a particular problem for town roads which are almost all gravel. Maintenance to roadside ditches to remove invasives is required to allow for runoff transportation.

Facilities that rely on native species, biodiversity or the health of surrounding ecosystems, such as outdoor recreation areas, public or botanical gardens or agricultural/forestry operations, are more vulnerable to impacts from invasive species.

#### **Natural Environment**

Invasive species can reduce the resilience of ecosystems to future hazards by placing a constant stress on the system (MEMA & EOEEA, 2018). A 1998 study found that competition or predation by alien species is the second most significant threat to biodiversity, only surpassed by direct habitat destruction or degradation (Wilcove et al., 1998). An analysis of threats to endangered and threatened species in the U.S. indicates that invasive species are implicated in the decline of 42% of the endangered and threatened species. In 18% of the cases, invasive species were listed as the primary cause of the species being threatened, whereas in 24% of the cases they were identified as a contributing factor (Somers, 2016). This indicates that invasive species present a significant threat to the environment and natural resources in the Commonwealth.

By any measure Mount Washington is a hotspot of biodiversity and conservation importance. The town contains headwaters of two of the state's Areas of Critical Environmental Concern (ACEC), places that are recognized by the state for the significance to natural habitat. Karner Brook on the northwest corner

<sup>&</sup>lt;sup>19</sup> DCR, <a href="https://storymaps.arcgis.com/collections/2c7858eea994482495ac2d7249e1b4ca?item=6">https://storymaps.arcgis.com/collections/2c7858eea994482495ac2d7249e1b4ca?item=6</a>, 2020

of Town contains at least 20 of the state's rare and endangered species while Schenob Brook on the southeast houses double that amount. Over 80% of the land is protected land, a hub for conservation groups such including The Nature Conservancy, Berkshire Natural Resource Council, Berkshire-Taconic Conservation Partnership, Berkshire Wildlife Linkages, and MassDCR. The town provides key connective habitat for wildlife corridor through the Taconic Mountains, a region that spans from New York up through Vermont. The unique high elevations provide important habitat for endemic species, especially important with rising temperatures. Mount Washington ranks highly using the state's Conservation Assessment and Prioritization System (CAPS), index of ecological integrity (IEI). Ecological integrity as the ability of an area to support biodiversity and the ecosystem processes necessary to sustain biodiversity over the long term.<sup>20</sup>

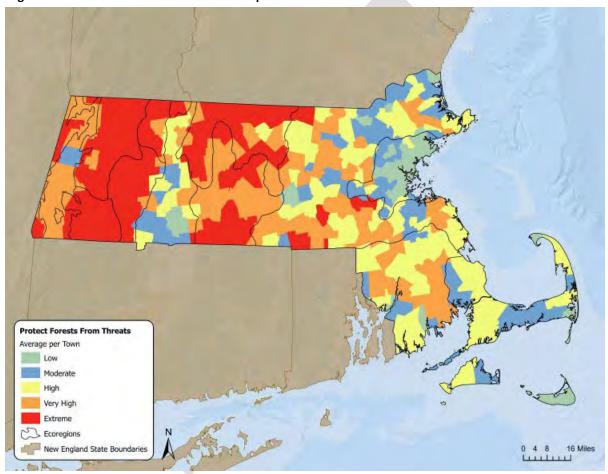


Figure 3.19. Protect Forests from Threats Map

Source: DCR, State Forest Action Plan, 2020

For these reasons, protection of natural resources and Mount Washington's unique ecosystem is paramount. DCR recognized as such in their 2020 State Forest Action Plan identifying the Town as in highest need of protection against insect invasives species threat (See Figure 3.17). These regions are where hazard mitigation practices would be most effective.

<sup>20</sup> UMass CAPS, 2020

#### **Economy**

Invasive species are widely considered to be one of the costliest natural hazards in the U.S. A widely cited paper found that invasive species cost the U.S. more than \$120 billion in damages every year. One study found that in one year alone, Massachusetts agencies spent more than \$500,000 on the control of invasive aquatic species through direct efforts and cost-share assistance. This figure does not include the extensive control efforts undertaken by municipalities, nonprofits, and private landowners, lost revenue due to decreased recreational opportunities, or decreases in property value due to infestations. Individuals who are particularly vulnerable to the economic impacts of this hazard would include all groups who depend on existing ecosystems in the Commonwealth for their economic success (MEMA & EOEEA, 2018).

In Mount Washington, ash trees along local roadways have been dwindling. Each year the Highway Department maintains a list of dying and dead roadside trees, and prioritizes trees that need to be trimmed or taken down. While some of the costs are due to the dying of trees damaged during successive ice or wind storms, or just from aging out, the cost of maintenance increases largely due to the damage done to ash trees by the emerald ash borer. Likewise, the cost of road maintenance increases in part due to clogged drainage and roadside invasives growth. Mount Washington Highway Dept. has partnered with the Town Invasive Species Taskforce to reduce invasives spread through altered operations. This past year, the Highway Staff participated in a training to reduce spread and impact to clogged drainage areas.

Forest-based employment in the recreation and tourism sector is quite broad, including not just the outfitters, guides, and sporting goods vendors, but also the full suite of support services, such as dining and lodging. These services facilitate and promote the enjoyment of the greater experience of engaging in forest-based recreation. Fall foliage viewing, camping, hiking, and snowmobiling are examples of exceedingly popular activities that hinge upon the greater forested landscape, but also require a host of support services to make them successful. Other noteworthy forest-based recreational activities include cross-country skiing, mountain biking, wildlife tracking, and birdwatching. A 2015 report estimated that about 9,000 people are employed in the diverse industries that support this sector, with a total annual payroll equivalent of \$293 million. Another report in 2020 estimated that forest related recreation was a \$2.2 billion industry in Massachusetts. This includes all individuals working in outdoor recreation activities and tourism based on maintaining a natural landscape. This is especially important in Berkshire County, where the scenic beauty and outdoor recreational opportunities complement the region's international status as a cultural destination.

#### **Future Conditions**

Invasive species can trigger a wide-ranging cascade of lost ecosystem services. Additionally, they can reduce the resilience of ecosystems to future hazards by placing a constant stress on the system. Temperature, concentration of  $CO_2$  in the atmosphere, frequency and intensity of hazardous events, atmospheric concentration of  $CO_2$ , and available nutrients are key factors in determining species survival. It is likely that climate change will alter all of these variables. As a result, climate change is likely to stress native ecosystems and increase the chances of a successful invasion. Additionally, some research suggests that elevated atmospheric  $CO_2$  concentrations could reduce the ability of ecosystems

<sup>&</sup>lt;sup>21</sup> EOEEA, DCR, Bureau of Forest Fire Control & Forestry, 2020.

<sup>&</sup>lt;sup>22</sup> DCR, Massachusetts Forest Action Plan, 2020.

to recover after a major disturbance, such as a flood or fire event. As a result, invasive species—which are often able to establish more rapidly following a disturbance—could have an increased probability of successful establishment or expansion. Other climate change impacts that could increase the severity of the invasive species hazard include the following (as cited in MEMA & EOEEA, 2018):

- Elevated atmospheric CO<sub>2</sub> levels could increase some organisms' photosynthetic rates, improving the competitive advantage of those species.
- Changes in atmospheric conditions could decrease the transpiration rates of some plants, increasing the amount of moisture in the underlying soil. Species that could most effectively capitalize on this increase in available water would become more competitive.
- Fossil fuel combustion can result in widespread nitrogen deposition, which tends to favor fastgrowing plant species. In some regions, these species are primarily invasive, so continued use of fossil fuels could make conditions more favorable for these species.
- As the growing season shifts to earlier in the year, several invasive species (including garlic mustard, barberry, buckthorn, and honeysuckle) have proven more able to capitalize by beginning to flower earlier, which allows them to outcompete later-blooming plants for available resources. Species whose flowering times do not respond to elevated temperatures have decreased in abundance.
- Some research has found that forests pests (which tend to be ectotherms, drawing their body heat from environmental sources) will flourish under warming temperatures. As a result, the population sizes of defoliating insects and bark beetles are likely to increase.
- Warmer winter temperatures also mean that fewer pests will be killed off over the winter season, allowing populations to grow beyond previous limits.
- There are many environmental changes possible in the aquatic environment that can impact the introduction, spread, and establishment of aquatic species, including increased water temperature, decreased oxygen concentration, and change in pH. For example, increases in winter water temperatures could facilitate year-round establishment of species that currently cannot overwinter in New England (Sorte, 2014 as cited in MEMA & EOEEA, 2018).

# Change in Average Temperatures / Extreme Temperatures

# Hazard Profile

Temperature is a fundamental measurement of describing climate, which is the prevailing weather patterns in a given area. Climate determines the types of plant and animal species that are able to survive in a region, and changes in climate will have significant impacts on the landscape because most species will not have the time to evolve and adapt over multiple generations to the new climate<sup>23</sup>. Data from several scientific sources indicate that 2011-2020 was the warmest decade recorded, <sup>24</sup> and this increase drives our weather patterns. The ocean's waters act as a "heat sink," and those warmer waters influence air temperatures and spawn a greater number and increased intensity of storms. In the Northeast we will generally see more frequent and more intense precipitation, heat waves, longer fall and spring, and warmer winters with heavier snow.

### Likely severity

Relative to the rest of the Commonwealth, the Town of Mount Washington is somewhat protected from extreme heat by the Town's higher elevation and heavy forest cover. Roads and homes tend to be located along the lower elevations in Town, around the 1,400-1,700 foot elevation, although elevations change dramatically within short distances. The environment and people have adapted to cooler conditions; however, extremes in hot and cold still can and will occur, particularly in the changing climate. Homes here have traditionally been built with heating systems and some level of insulation to keep in warmth, but few were built with central air conditioning systems.

NOAA utilizes data to determine average temperature using land-based weather station measurements and by satellite measurements that cover the lowest level of the Earth's atmosphere. In moderate climate like in the Berkshires, the most severe impacts of the change in average temperature will be on our environmental composition, as well as on our vulnerable populations, particularly the elderly, people with underlying health conditions and low-income residents.

A heat wave is defined as three or more days of temperatures of 90°F or above. A basic definition of a heat wave implies that it is an extended period of unusually high atmosphere-related heat stress, which causes temporary modifications in lifestyle and which may have adverse health consequences for the affected population (MEMA & EOEEA, 2018).

The extent (severity or magnitude) of extreme cold temperatures is generally measured through the Wind Chill Temperature Index. Wind Chill is the temperature that people and animals feel when they are outside, and it is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body loses heat at a faster rate, causing the skin's temperature to drop.

# **Probability**

<sup>&</sup>lt;sup>23</sup> https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-temperature

<sup>24</sup> https://climate.copernicus.eu/2020-warmest-year-record-europe-globally-2020-ties-2016-warmest-year-recorded#:~:text=The%20Copernicus%20Climate%20Change%20Service%20(C3S)%20today%20reveals%20that%20globally,2020%20the%20warmest%20decade%20recorded

According to extensive scientific study, the global changes in climate will lead to temperature shifts as weather patterns are altered. In general air temperatures are increasing across the globe, with relatively higher increases in the Northeast than in most other portions of the U.S. The Massachusetts Climate Change Clearinghouse (resilient MA) is a gateway to data and information relevant to climate change adaptation and mitigation across the state. It provides the most up-to-date climate change science and decision support tools to support scientifically sound and cost-effective decision making for policy-makers, practitioners, and the public. As part of this effort, the clearinghouse is linked to the Department of Interior's Northeast Climate Adaptation Science Center (NE CASC), which is hosted by the University of Massachusetts, Amherst. NE CASC is part of a federal network of eight Climate Adaptation Science Centers created to work with natural and cultural resource managers to gather the scientific information and build the tools needed to help fish, wildlife, and ecosystems adapt to the impacts of climate change.

NE CASC is the main source used in this hazard mitigation plan to understand observed and projected changes in temperatures. Climate change projections for Massachusetts are based on simulations from the latest generation of climate models included in the Coupled Model Intercomparison Project Phase 5 (CMIP5). As part of this work, the state created projections on county- and major watershed-level information, derived by statistically downscaling CMIP5 model results using the Local Constructed Analogs (LOCA) method (Pierce et al., 2014). As noted in the CMIP5 models, the state-wide temperatures are expected to rise and cause these projections for the mid-21st century (2050s), as relative to the observed 1971-2000 baseline average. The details for projections for mid-century and 2090s are outlined in Table 3.12.<sup>25</sup>

Cooling degree days (CDD) are a measure of how much and for how long outside air temperature was higher than a specific base temperature. CDDs are the difference between the average daily temperature and 65°F, which has been determined to be a temperature that does not typically call for use of indoor cooling systems. For example, if the temperature mean is 90°F, subtract 65 from the mean and the result is 25 CCDs for that day. Similarly, heating degree days are those where the temperature is lower than 65°F. If the temperature is 30°F, subtract the mean from 65 and the result is 30 HDD for that day.

Table 3.12. Projected Statewide Temperature Changes from Observed 1971-2000 to Projected 2050s and 2090s

Variable	Observed value 1971 - 2000 average	Change by 2050s	Change by 2090s
Annual average temperature	47.5°F	Increase by 2.8 - 6.2°F	Increase by 3.8 - 10.8°F
Number of days per year with daily Total max > 90°F	5 days	Increase by 7 - 26 days	Increase by 10 - 63 days
Number of days per year with daily Total min < 32°F	146 days	Decrease by 19 - 40 days	Decrease by 24 - 64 days
Heating degree-days per year (HDD)	6839 Degree-Day °F	Decrease by 773 - 1627	Decrease by 1033 - 2533
Cooling degree-days per year (CDD)	457 Degree-Day °F	Increase by 261 - 689	Increase by 356 - 1417

Source: https://resilientma.org/datagrapher/?c=Temp/state/maxt/ANN/MA/

#### **Geographic Areas Likely Impacted**

<sup>25</sup> https://resilientma.org/datagrapher/?c=Temp/state/maxt/ANN/MA/

All of Mount Washington exposed to the impacts of increased annual and extreme temperatures. The Town's gravel roads are impacted more severely during the increased freeze/thaw cycles that are occurring during the winter season. Most of Town is located within the Bash Bish Brook Watershed, which is part of the greater Hudson River Watershed. However, the southeast corner and the most northern sections of the Town are located within the Housatonic River Watershed. Since the majority of homes in the Town are located within the Bash Bish Brook Watershed, temperature data from the Hudson River Watershed data will be used in this analysis.

#### **Historic Data**

According to according to scientists from NOAA's National Centers for Environmental Information (NCEI), the last seven years prior to 2020 were the hottest years on record, as ranked by their departure from the 20th century average temperature. Projections by NOAA and other scientific organizations across the globe expect the trend to continue upwards, with the magnitude of the change depending on the amount of greenhouse gas levels in the atmosphere. In general, the highest temperatures in the Berkshires occur in July, and the lowest tend to occur in January.

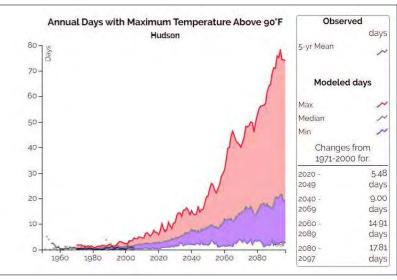
The following are some of the highest temperatures recorded for the period from 1895 to 2017, showing as comparison Boston and three Berkshire County locations (National Climatic Data Center, 2017.)

- Boston, MA 102°F
- Great Barrington, MA 99°F
- Adams, MA 95°F
- Pittsfield, MA 95°F

Historically, Mount Washington has little experience with days when the air temperature exceeds 90°F, but that will soon change as we see an increase in the number of days with dangerous levels of heat. As seen in Figure 3.18, during the years 1960-2000, there were few if any days where the temperature was above 90°F in the Housatonic River Watershed.

During the baseline years 1971-2000 there was an average of 1.3 days per summer when the temperature exceeded 90°F in the Hudson River Watershed in Massachusetts. <sup>26</sup> The CMIP5

Figure 3.20. Observed and Projected Extreme Temperatures for Hudson River Watershed



model offered by the NE CASC projects that the median number of days per year when the air temperature exceeds 90°F will increase to nine per year by mid-century and to 18 by the 2090s. Under a high-greenhouse gas emissions

Source: NE CASC, 2017.

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 $<sup>^{26}</sup>$  MA Climate Change Projections by Basin report, 2017.

scenario, the maximum number of days when the air temperature exceed 90°F could reach 26 days per year by mid-century and 74 days per year by the 2090s (NE CASC 2017).<sup>27</sup>

Just as the summers tend to be cooler in the Berkshires than in other parts of the state, so too are the winters. Again, the slightly higher elevations of the Berkshire hills are largely responsible for the cooler temperatures, and Mount Washington has some of the highest elevations outside of the Mount Greylock complex. The following are some of the lowest temperatures recorded in the Berkshire region for the period from 1895 to 2017 (National Climatic Data Center, 2017).

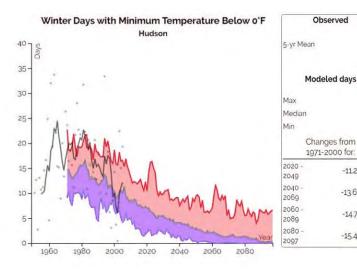
- Lanesborough, MA –28°F
- Great Barrington, MA –27°F
- Stockbridge, MA -24°F
- Pittsfield, MA -19°F

In the same manner that climate change will increase summer high temperatures, so too will it increase the lower winter temperatures. As illustrated in Figure 3.19, the number of observed winter days when the temperature dipped below 0°F has historically been unpredictable during the years 1960-2000. The 5-year mean trend line shows that there was quite a range where temperatures fell below 0°F, with as few as 9 days in 1999 and 13 days in 1969 and a high of 15 days in 1965. The baseline years of 1971-

2000 averaged 17 days in the winter where the temperature fell below 0°F. By mid-century the median number of days where temperatures will fall below 0°F will decrease by 14 days, meaning there will only be 3 days of below 0 temperatures. By 2090 there will less than one (0.39 days) where the temperature will fall that low.<sup>28</sup> This will bring some relief and reduce risk to people and buildings from extreme low temperatures.

As described earlier in the Flood Risk Section of the plan, this change has implications for snow and ice management, with snows being heavier, snow melts more often and ice formation more often.

Figure 3.21. Observed and Projected Extreme Temperatures for Hudson River Watershed



Source: NE CASC, 2017.

days

-13.60days

-14.75days

-15.49days

<sup>&</sup>lt;sup>27</sup> NE CASC, 2017. https://resilientma.org/datagrapher/?c=Temp/basin/tx90/JJA/Hudson/

<sup>&</sup>lt;sup>28</sup> NE CASC, 2017, https://resilientma.org/datagrapher/?c=Temp/basin/tn0/DJF/Hudson/

## **Vulnerability Assessment**

### People

All residents in the Town of Mount Washington are vulnerable to the health effects of extreme temperatures, with those who work outside directly at a greater risk. According to the Centers for Disease Control and Prevention, populations most at risk to extreme heat and cold events include the following: (1) people over the age of 65, who are less able to withstand or regulate temperatures extremes due to their age, health conditions, and limited mobility to access shelters; (2) infants and children under 5 years of age; (3) individuals with pre-existing medical conditions that impair heat tolerance (e.g., heart disease or kidney disease); (4) low-income individuals who cannot afford proper heating and cooling; (5) people with respiratory conditions, such as asthma or chronic obstructive pulmonary disease; and (6) the general public who may overexert themselves when working or exercising during extreme heat events or who may experience hypothermia during extreme cold events. Berkshire County has a higher level of asthma-related emergency room visits than other parts of the state. Additionally, people who live alone—particularly the elderly and individuals with disabilities—are at higher risk of heat-related illness due to their isolation and reluctance to relocate to cooler environments.

The NWS issues a Heat Advisory when the Heat Index is forecast to reach 100°-104°F for two or more hours. The NWS issues an Excessive Heat Warning if the Heat Index is forecast to reach 105°F or more for two or more hours. The NWS Heat Index is based both on temperature and relative humidity and describes a temperature equivalent to what a person would feel at a baseline humidity level. It is scaled to the ability of a person to lose heat to their environment. It is important to know that the heat index values are devised for shady, light wind conditions. Exposure to full sunshine can increase heat index values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can increase the risk of heat-related impacts.

When people are exposed to extreme heat, they can suffer from potentially deadly illnesses, such as heat exhaustion and heat stroke. Heat is the leading weather-related killer in the U.S., even though most heat-related deaths are preventable through outreach and intervention (EPA, 2016). A study of heat-related deaths across Massachusetts estimated that when the temperature rises above the 85th percentile (hot: 85-86°F), 90th percentile (very hot: 87-89°F) and 95th percentile (extremely hot: 89-92°F) there are between five and seven excess deaths per day in Massachusetts. It should be noted that temperature alone does not define the stress that heat can have on the human body – humidity plays a

powerful role in human health impacts, particularly for those with pre-existing pulmonary or cardio-vascular conditions.

Locally, a significant increase in heat-related deaths has not been reported in Berkshire County. When interviewed in 2016 about projected climate change impacts, local ambulance crews reported no increase in heat-related calls in recent years (BRPC &

Figure 3.22. Heat Index Chart and Human Health Impacts

				_ X				Ten	nperatui	e (°F)							
		80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
	40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
	45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
	50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
8	55	81	84	86	89	93	97	101	106	112	117	124	130	137			
Relative Humidity (%)	60	82	84	88	91	95	100	105	110	116	123	129	137				
Ē	65	82	85	89	93	98	103	108	114	121	128	136					
e H	70	83	86	90	95	100	105	112	119	126	134						
lativ	75	84	88	92	97	103	109	116	124	132							
Re	80	84	89	94	100	106	113	121	129								
	85	85	90	96	102	110	117	128	135								
	90	86	91	98	105	113	122	131									
	95	86	93	100	108	117	127										
	100	87	95	103	112	121	132										
Cat	egory			Heat	Index						lealth	Hazai	ds				
Extr	eme Da	nger	1	30 F -	Higher	Hea	t Stroke	or Sun	stroke	s likely	With co	ntimied	ехрови	re.			
Dan	Danger			05 °F -	129 °F		Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.										
Extre	Extreme Caution			00 °F −	105 °F		Sunstroke, muscle cramps, and/or heat exhaustions possible with prolonged exposure and/or physical activity.										
Cau	tion			80 °F -	90 °F	Fati	gue pos	sible w	ith prolo	nged e	xposure	and/or	physica	al activit	v.		

Source: EOEEA & MEMA, 2013.

BCBOHA, 2016). However, many Berkshire communities since that time have begun to develop protocols for opening cooling centers. Otis has opened its cooling center during a heat event in 2019, posting its availability on the Town's Blackboard Connect emergency communications system. One person used the cooling center during this period.

What may be more concerning is the trend for higher nighttime temperatures. Warm nights are those where the minimum temperature stays above 70°F. As can be seen in Figure 3.14, the number of nights where the temperature did not dip below 70°F has increased from a median of slightly more than three in the years 1950 – 1990, to greater than seven in the 2010s. Historically the cooler evening temperatures in the Berkshires has allowed residents to cool their body temperatures in the night air and to cool their homes by opening windows and using fans to bring in the cooler air. Human bodies need time to cool off, which typically occurs during sleep when core body temperature naturally dips. Without relief during the night the physiological strain on the body continues unabated. When it is both too hot and too humid for sweat to do its job of dissipating body heat, there can be fatal consequences like organ failure. Warmer and more humid nighttime temperatures will make it increasingly difficult to bring down the temperature in homes that are not equipped with air conditioning.

In the Berkshires, extreme cold temperatures are those that are well below zero for a sustained period of time, causing distress for vulnerable populations that are exposed to the temperatures when outside and straining home heating systems. The severity of extreme cold temperatures are generally measured through the Wind Chill Temperature Index. Wind Chill Temperature is the temperature that people and animals feel when outside and it is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body is cooled at a faster rate causing the skin's temperature to drop (MEMA, 2013)

Figure 3.23. Number of Nights When Temperatures Remain 70°F or Higher



The NWS issues a Wind Chill Advisory if the Wind Chill Index is forecast to dip to  $-15^{\circ}$ F to  $-24^{\circ}$ F for at least three hours, using only the sustained winds (not gusts). The NWS issues a Wind Chill Warning if the Wind Chill Index is forecast to fall to  $-25^{\circ}$ F or colder for at least three hours using only the sustained wind. In 2001 the NWS implemented a Wind Chill Temperature Index to more accurately calculate how cold air feels on human skin and to predict the threat of frostbite. According to the calculations, people can get frostbite in as little as 10 minutes when the temperature is -10°F degrees and winds are 15 miles per hour. (MEMA, 2013).

Figure 3.24. Wind Chill Temperature Index and Frostbite Risk

									Tem	pera	ture	(°F)							
•	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
	5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
	10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
	15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
	20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
Jh)	25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
(mph)	30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
ᅙ	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
Wind	40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
	45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
	50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
	55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
	60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98
			w		Frostb				0.62			75(V		_	275	r(V <sup>0.1</sup>	16)		

Source: EOEEA & MEMA, 2013.

#### **Built Environment**

All elements of the built environment are exposed to the extreme temperature hazards. The impacts of extreme heat on buildings include: increased thermal stresses on building materials, which leads to greater wear and tear and reduces a building's useful lifespan; increased air-conditioning demand to maintain a comfortable temperature; overheated heating, ventilation, and air-conditioning systems; and disruptions in service associated with power outages (resilient MA, 2018).

Warmer annual winter temperatures are less consistent than in the past. Warm "false spring" periods have become more common. This results in more freeze/thaw events that begin earlier in late winter/early spring. In other words, the infamous New England "mud season" starts earlier and has more thaw events. In Mount Washington, where historically mud season would occur in late March/early April, during the 2021-22 winter months there were nine distinct mud season events that the highway department had to respond to. The shifting seasons are already driving up costs to maintain dirt roads and ensure safe passage for vehicles.

The shifting and warming winter temperatures are a major concern that has cost implications to the Town of Mount Washington and safety concerns for residents. In general, the Town's roads were built to accommodate low or moderate traffic and were not built with a base that can withstand high traffic numbers or heavy loads. However, as more seasonal homeowners are visiting their properties year-round and visitorship to state properties increase, the roads are experiencing a greater number of vehicle trips. This increased use can lead to road damage and failure. The Highway Department is already experiencing greater workload and costs related to road maintenance and repairs caused by extreme weather events and heavier traffic volumes.

The Highway Department would like to address roads that are failing due to washouts and the increased number of annual freeze/thaw cycles. To mitigate these issues on a more permanent, long-term basis will require that some roads undergo full-depth reconstruction to establish a proper sub-base. Some residents are asking that gravel roads be converted to paved roads. In recent written testimony to the Massachusetts legislature, the Town Administrator of Ashfield, a rural town in Franklin County, estimated that it costs \$300,000-400,000 per mile to rebuild a gravel road, and \$1 million per mile to rebuild and pave a road.<sup>29</sup>

Extreme cold temperature events can damage buildings through freezing or bursting pipes and freeze and thaw cycles. Additionally, manufactured buildings (trailers and mobile homes) and antiquated or poorly constructed facilities may not be able to withstand extreme temperatures. The heavy snowfall and ice storms associated with extreme cold temperature events can also cause power interruptions. Backup power is recommended for critical facilities and infrastructure. Extreme cold can cause materials such as plastic to become less pliable, increasing the potential for these materials to break down during extreme cold events (resilient MA, 2018). In addition to the facility-specific impacts, extreme temperatures can impact critical infrastructure sectors of the built environment in a number of ways, which are summarized in the subsections that follow.

The Berkshires are currently a moderately temperate climate, but an increase in summer temperatures will create higher peak summer electricity demands for cooling, particularly with an increase in the

<sup>&</sup>lt;sup>29</sup> Jin, Danny, 1-26-22. "Mud season has long caused driving headaches in Western Mass. A new proposal asks the state to look at the issue." Berkshire Eagle, Pittsfield, MA

number of air conditioning units being installed. In the summer, the number of CDDs was 189 in the Hudson River Watershed of Massachusetts for the baseline years of 1971-2000. The summer CDD rate is expected to increase by 94-237% (additional 177-448 degree-days) by mid-century, and by 126-469% (additional 238-886 degree-days) by end of century (NE CASC, 2017).<sup>30</sup> Historically CDD demand has been concentrated in the summer months, but as the climate warms, need for air conditioning can be expected to expand outward into the shoulder months of spring and autumn.

Extreme heat has potential impacts on the design and operation of the transportation system. Impacts on the design include the instability of materials, particularly pavement, exposed to high temperatures over longer periods of time, which can cause buckling and lead to increased failures (MassDOT, 2017). High heat can cause pavement to soften and expand, creating ruts, potholes, and jarring, and placing additional stress on bridge joints. Extreme heat may cause heat stress in materials such as asphalt and increase the frequency of repairs and replacements (resilient MA, 2018).

#### **Natural Environment**

There are numerous ways in which changing temperatures will impact the natural environment. Because the species that exist in a given area have adapted to survive within a specific temperature range, extreme temperature events can place significant stress both on individual species and the ecosystems in which they function. High-elevation spruce-fir forests, forested boreal swamp, and higher-elevation northern hardwoods are likely to be highly vulnerable to climate change (MCCS and DFW, 2010). Higher summer temperatures will disrupt wetland hydrology. Paired with a higher incidence and severity of droughts, high temperatures and evapotranspiration rates could lead to habitat loss and wetlands drying out (MCCS and DFW, 2010).

Higher summer temperatures will disrupt wetland hydrology. Paired with a higher incidence and severity of droughts, high temperatures and evapotranspiration rates could lead to habitat loss and wetlands drying out (MCCS and DFW, 2010). Individual extreme weather events usually have a limited long-term impact on natural systems, although unusual frost events occurring after plants begin to bloom in the spring can cause significant damage. However, the impact on natural resources of changing average temperatures and the changing frequency of extreme climate events is likely to be massive and widespread.

### **Economy**

The agricultural industry is most directly at risk in terms of economic impact and damage due to extreme temperature and drought events. Above average, below average, and extreme temperatures are likely to impact crops—such as apples, cranberries, and maple syrup—that rely on specific temperature regimes (resilient MA, 2018). There is little agricultural activity in Mount Washington.

The Town's revenue is almost totally dependent on real estate taxes, with many of the homes being second homes. Mount Washington, like the much of rural Berkshire County, already experiences a substantial population increase during the summer months as second homes and overnight camps fill to capacity. As spring and fall temperatures are become milder, many summer residents are already

MA Climate Change Projections, https://eea-nescaum-dataservices-assets-prd.s3.us-east-1.amazonaws.com/resources/production/MA%20Statewide%20and%20MajorBasins%20Climate%20Projections\_Guidebook%20Supplement\_March2018.pdf

extending their stay in the region. Many residents retreated to their second homes during the COVID pandemic years and have found that they can effectively work here year-round, particularly given Mount Washington's excellent high speed internet service. This new freedom to work from home may have long-term impacts on the Town's demand for public services and education.

There are few businesses operating out of Mount Washington, and many of them are small businesses whose operations are able to be conducted online.

#### **Future Conditions**

According to NOAA, global temperature data document a warming trend since the mid-1970s. Temperature changes will be gradual over the years. However, for the extremes, meteorologists can accurately forecast event development and the severity of the associated conditions with several days lead time. High, low, and average temperatures in Massachusetts are all likely to increase significantly over the next century as a result of climate change. Increased electricity demand for CDDs throughout the northeast could stress the New England electricity grid system and lead to brownouts or controlled blackouts, stressing or injuring the health of vulnerable populations and possibly impairing functions of government and communications systems.

For the Town of Mount Washington, there will be a need to identify and maintain communications with vulnerable populations such as the elderly, people with underlying health problems, and low-income residents whose homes do not have cooling systems adequate to bring down indoor temperatures. As warming temperatures become more common the need for a cooling shelter may be necessary as a part of the emergency response strategy for the Town. This will be increasingly important as second homeowners spend more time in the Town or retire here.

Climate change is anticipated to be the second-greatest contributor to this biodiversity crisis, which is predicted to change global land use. One significant impact of increasing temperatures may be the northern migration of plants and animals. Over time, shifting habitat may result in a geographic mismatch between the location of conservation land and the location of critical habitats and species the conserved land was designed to protect. Between 1999 and 2018 (fiscal years), the Commonwealth spent more than \$395 million on the acquisition of more than 143,033 acres of land and has managed this land under the assumption of a stable climate. As species respond to climate change, they will likely continue to shift their ranges or change their phenologies to track optimal conditions (MCCS and DFW, 2010). As a result, climate change will have significant impacts on traditional methods of wildlife and habitat management, including land conservation and mitigation of non-climate stressors (MCCS and DFW, 2010).

Changing temperatures, particularly increasing temperatures, will also have a major impact on the sustainability of our waterways and the connectivity of aquatic habitats (i.e., entire portions of major rivers will dry up, limiting fish passage down the rivers). Additional impacts of warming temperatures include the increased survival and grazing damage of white-tailed deer, increased invasion rates of invasive plants, and increased survival and productivity of insect pests, which cause damage to forests (MCCS and DFW, 2010). As temperature increases, the length of the growing season will also increase.

Climate change is also likely to result in a shift in the timing and durations of various seasons. This change will likely have repercussions on the life cycles of both flora and fauna within the Commonwealth. While there could be economic benefits from a lengthened growing season, a

lengthened season also carries a number of risks. The probability of frost damage will increase, as the earlier arrival of warm temperatures may cause many trees and flowers to blossom prematurely only to experience a subsequent frost. Additionally, pests and diseases may also have a greater impact in a drier world, as they will begin feeding and breeding earlier in the year (Land Trust Alliance, n.d. as cited in MEMA & EOEEA, 2018).



## **Tornadoes**

## Hazard Profile

### **Likely Severity**

Tornadoes are potentially the most dangerous of local storms. If a major tornado were to strike damage could be significant, particularly if there is a home or other facility in its path. Many people could be displaced for an extended period of time; buildings could be damaged or destroyed; businesses could be forced to close for an extended period of time or even permanently; and routine services, such as telephone or power, could be disrupted.

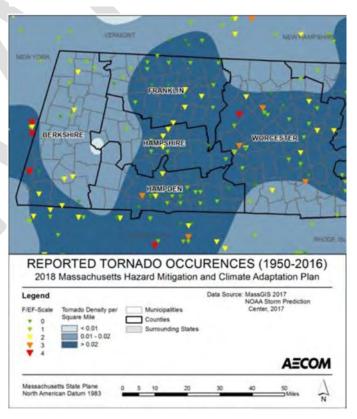
The NWS rates tornadoes using the Enhanced Fujita scale (EF scale), which does not directly measure wind speed but rather the amount of damage created. This scale derives 3-second gusts estimated at the point of damage based on the assignment of 1 out of 8 degrees of damage to a range of different structure types. These estimates vary with height and exposure.

#### **Probability**

The location of tornado impact is totally unpredictable. Tornadoes are fierce phenomena which generate wind funnels of up to 200 MPH or more, and occur in Massachusetts usually during June, July, and August, although the county's most devastating was in Great Barrington in May. From 1950 to 2017, the Commonwealth experienced 171 tornadoes, or an average annual occurrence of 2.6 tornado events per year. In the last 20 years, the average frequency of these events has been 1.7 events per year (NOAA, 2018). Massachusetts experienced an average of 1.4 tornadoes per 10,000 square feet annually between 1991 and 2010, less than half of the national average of 3.5 tornadoes per 10,000 square feet per year (NOAA, n.d. as cited in MEMA & EOEEA, 2018).

According to the National Climatic Data Center, since 1950, there have been 13 tornados that have touched down or moved in a path across Berkshire County, and there are several others that occurred in adjacent counties and states in the region. The most recent of these was in July 2014 when a F1 tornado struck in Dalton. This averages to

Figure 3.25. Density of Reported Tornadoes per Square Mile



Source: MEMA, 2018, from NOAA Storm Prediction Center (SPC)

one tornado striking the county approximately every five years. Of these, only two have been of a severity of an EF4, which indicates that such a severe tornado has a statistical recurrence rate of one in every 33 years. (NOAA, 2017).

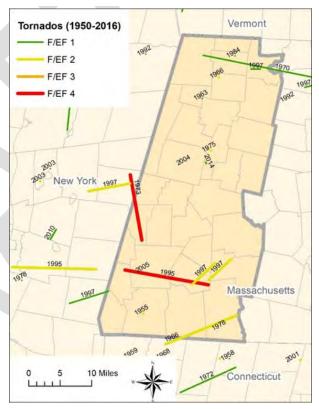
## **Geographic Areas Likely Impacted**

While the area impacted by a tornado will be limited at the time of the event, anywhere in Mount Washington is susceptible. Figure 3.16 shows where tornadoes density is greatest in Massachusetts through 2016.

#### **Historic Data**

The National Climatic Data Center reports data on tornado events and does so as far back as 1950. Of the 18 tornados that have occurred in Berkshire County between 1950 and 2018, only one has occurred since 2007, an EF1 in July 2014 in Dalton. Four tornados occurred during a single storm on July 3, 1997. These have resulted in over \$29 million in damage, seven deaths, and 60+ injuries. (NOAA, 2017). The most memorable tornados in recent history occurred in West Stockbridge in August of 1973 (category F4) and in Great Barrington, Egremont, and Monterey in May of 1995 (category F4). In the West Stockbridge tornado four people died and 36 were injured, and in Great Barrington three people died and 24 were injured. The signs of the tornado's destruction are still visible today in Great Barrington from Rt. 7. The hill to the east is scarred where the tornado uprooted and toppled trees (MEMA & EOEEA, 2018). As can be seen in Figure 3.24, tornados have also been active in neighboring Columbia and Rensselaer Counties in New York State, including one in the neighboring town of Copake in 1997.

Fig. 3.26. Tornados in the Berkshire Region and their Severity



Source: Midwest Regional Climate Center, 2018.

# **Vulnerability Assessment**

#### People

In general, vulnerable populations include seniors, people with underlying health issues and disadvantaged populations. Individuals with limited communication capacity, such as those with limited internet or phone access, may not be aware of impending tornado warnings. The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible. This short warning time is part of why tornados are so dangerous. Tornado watches and warnings are issued by the local NWS office. A tornado watch is released when tornadoes are possible in an area. A tornado warning means a tornado has been sighted or indicated by weather

radar. (MEMA, 2018). Power outages resulting from tornado or high winds can be life-threatening to those who are dependent on electricity for life support.

In Mount Washington, warning systems are broadcast through a Blackboard Connect, a system that reaches at least 80% of the community. This alert is issued by the Emergency Management Director in collaboration with the Egremont Fire Chief. Alerts are also broadcast through television stations via satellite TV companies or local and regional radio stations. Mount Washington is located within the Albany satellite market, so its news and weather forecasts comes from local stations based in Albany, NY. Weather apps are available to download onto smart phones and tablets, but it is unknown how many residents subscribe to such apps. Summer, when tornadoes are most apt to form, is when the Town's population increases significantly with second homeowners and children at Camp Hi-Rock. Summer is also a time to enjoy the great outdoors for both residents and visitors alike, and it is likely that most people would not be near a TV or radio if a tornado warning is issued. Camp Hi-Rock has upto-date Emergency Action Plan in case of severe weather.

#### **Built Environment**

All buildings and structures in Mount Washington are at risk from tornados. Aside from potential damage to the buildings themselves, loss of electricity would mean that well pumps would not function and residents would lack drinking and waste water. If a tornado hit a large expanse of Mount Washington and/or its neighboring towns, electricity could be out for several days, as was the case when the ice storm of 2008 struck the Berkshire Hilltowns.

All critical facilities and infrastructure are exposed to tornado events. High winds could down power lines and poles adjacent to roads (resilient MA, 2018). Damage to aboveground transmission infrastructure can result in extended power outages. This would lead to internet interruptions, which is a major communications link in Mount Washington given that cell phone services is spotty at best. Incapacity and loss of roads and bridges are the primary transportation failures resulting from tornadoes, and these failures are primarily associated with secondary hazards, such as landslide events. Tornadoes can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating populations, and disrupting ingress and egress. Of particular concern are bridges and roads providing access to isolated areas and to the elderly (MEMA & EOEEA, 2018). The hail, wind, debris, and flash flooding associated with tornadoes can cause damage to infrastructure, such as storage tanks, hydrants, and distribution systems. This can result in loss of service or reduced pressure throughout the system (EPA, 2015). Water and wastewater utilities are also vulnerable to potential contamination due to chemical leaks from ruptured containers. Ruptured service lines in damaged buildings and broken hydrants can lead to loss of water and pressure (EPA, 2015 as cited in MEMA & EOEEA, 2018).

#### **Natural environment**

Direct impacts may occur to flora and fauna small enough to be uprooted and transported by the tornado. Even if the winds are not sufficient to transport trees and other large plants, they may still uproot them, causing significant damage to the surrounding habitat. As felled trees decompose, the increased dry matter may increase the threat of wildfire in vegetated areas. Additionally, the loss of root systems increases the potential for soil erosion. Disturbances created by blowdown events may also impact the biodiversity and composition of the forest ecosystem. Invasive plant species are often able to quickly capitalize on the resources (such as sunlight) available in disturbed and damaged ecosystems.

This enables them to gain a foothold and establish quickly with less competition from native species. In addition to damaging existing ecosystems, material transported by tornadoes can also cause environmental havoc in surrounding areas. Particular challenges are presented by the possibility of asbestos-contaminated building materials or other hazardous waste being transported to natural areas or bodies of water, which could then become contaminated.

### **Economy**

Forestry species and agricultural crops, equipment, and infrastructure may be directly impacted by tornadoes. Tornado events are typically localized; however, in those areas, economic impacts can be significant. Types of impacts may include loss of business functions, water supply system damage, damage to inventories, relocation costs, wage losses, and rental losses due to the repair or replacement of buildings. Recovery and clean-up costs can also be costly. The damage inflicted by historical tornadoes in Massachusetts varies widely, but the average damage per event is approximately \$3.9 million (MEMA, 2018).

#### **Future Conditions**

Tornado activity in the U.S. has become more variable, and increasingly so in the last two decades. While the number of days per year that tornadoes occur has decreased, the number of tornadoes on these days has increased. Climate models show projections that the frequency and intensity of severe thunderstorms (which include tornadoes, hail, and winds) will increase (USGCRP, 2017 as cited in MEMA & EOEEA, 2018). The short warning time combined with the lack of a public warning system that could be widely transmitted to households in Mount Washington increases the risk of people to tornadoes.

## Wildfires

## Hazard Profile

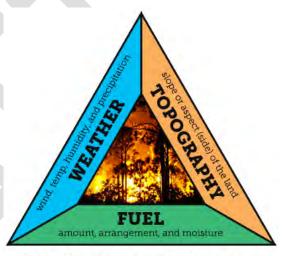
A wildfire can be defined as any non-structure fire that occurs in vegetative wildland that contains grass, shrub, leaf litter, and forested tree fuels. Wildfires in Massachusetts are caused by natural events, human activity, or prescribed fire. Wildfires often begin unnoticed but spread quickly, igniting brush, trees, and potentially homes (MEMA & EOEEA, 2018).

#### Likely severity

Given that Mount Washington is 93% forested, and that its neighboring communities are also heavily forested, the risk of wildfire is definitely present. The risk of fire being able to become established and spread is greater here due to the fact the responding volunteer fire department is in neighboring Egremont or Copake NY. It can take 30 minutes to respond to fires here due to the distance firefighters must travel.

The "wildfire behavior triangle" reflects how three primary factors influence wildfire behavior: fuel, topography, and weather. Each point of the triangle represents one of the three factors, and arrows along the sides represent the interplay between the factors. For example, drier and warmer weather with low relative humidity combined with dense fuel loads and steeper slopes can result in dangerous to extreme fire behavior. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain.

Fig. 3.27. Fire Behavior Triangle



# **Fire Behavior Triangle**

Source: WeatherSTEM

### **Fuel**

- Lighter fuels such as grasses, leaves, and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs, and trunks take longer to warm and ignite.
- Snags and hazard trees, especially those that are diseased or dying, become receptive to ignition
  when influenced by environmental factors such as drought, low humidity, and warm
  temperatures.

#### Weather

- Strong winds, especially wind events that persist for long periods or ones with significant sustained wind speeds, can exacerbate extreme fire conditions or accelerate the spread of wildfire.
- Dry spring and summer conditions, or drought at any point of the year, increases fire risk. Similarly, the passage of a dry, cold front through the region can result in sudden wind speed increases and changes in wind direction.

• Thunderstorms in Massachusetts are usually accompanied by rainfall; however, during periods of drought, lightning from thunderstorm cells can result in fire ignition. Thunderstorms with little or no rainfall are rare in New England but have occurred.

#### Terrain

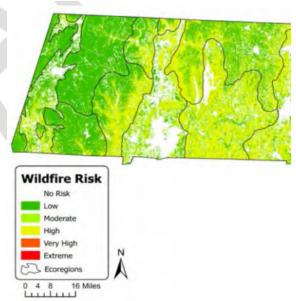
- Topography of a region or a local area influences the amount and moisture of fuel.
- Barriers such as highways and lakes can affect the spread of fire.
- Elevation and slope of landforms can influence fire behavior because fire spreads more easily uphill compared to downhill.

### **Probability**

It is difficult to predict the likelihood of wildfires in a probabilistic manner because a number of factors affect fire potential and because some conditions (e.g., ongoing land use development patterns, location, and fuel sources) exert changing pressure on the wildland-urban interface zone. There is at least one notable wildfire that erupts in the Commonwealth each year. However, based on the frequency of past occurrences in the region, the probably of Mount Washington being impacted is fairly low.

According to the 2020 Massachusetts State Forest Action Plan, there are relatively few natural forest fires in the state because lightning is almost always accompanied by rain. Fires occur primarily as a result of human activity; thus, the risk of forest fire increases in forest areas that are close to development and/or open to public use. A working group led by the U.S. Forest Service developed the Northeast Wildfire Risk Assessment model that considered three components: 1) fuels, 2) wildland-urban interface, and 3) topography (slope and aspect). These three characteristics are combined to identify wildfire prone areas where hazard mitigation practices would be most effective. As seen in Figure 3.25, Mount Washington has been assessed to have Low Wildfire Risk. High and very high-risk areas have fire prone forest types (pitch pine-scrub oak and oak) and significant forest-human interaction, and large expanses of these areas are found in the eastern portion of the state. According to the Natural Heritage & Endangered Species Program, Mount Washington has four populations Ridgeline Pitch Pine – Scrub Oak plant communities, with one large population which is in

Figure 3.28. Wildland-Urban Interface and Intermix for the Commonwealth of Massachusetts



Source: Northeast Wildfire Risk Assessment Geospatial Working Group 2009

excellent ecological condition, a rarity in Western Massachusetts. Trees in these pitch pine communities are unusual in that they are dwarfed, probably due to the harsh weather conditions and thin soils found on the ridgelines, and their cones open for regeneration without the required frequent bouts of fire that other pitch pine populations rely on. At an estimated 228 years old, the oldest known pitch pine tree in the state is found in the Mt. Everett State Reservation.

The assessment model has a flaw in that it does not take into account human activity outside the wildland interface and intermix areas. Local firefighters and other first responders highlight the fact that many wildland fires occur in remote areas where campfires or discarded lit cigarettes were the cause of the fire and, due to lack of access, the fires can get an extensive start before fire crews and equipment can reach these areas. As an example, the two largest wildfires in Berkshire County within the last 100 years, that of April 2015 (272 acres burned) and May 2021 (950+ acres burned), were located in areas in Clarksburg assessed as Low Wildfire Risk. The cause of the 2015 was a campfire that got out of control along the Appalachian Trail. The cause of the 2021 fire was not specifically determined but dry forest leaves and kindling due to drought caused its spread. The assessment modeling had predicted that there was a low risk of wildfire in the areas in Clarksburg where the fires occurred, presumably because of a lack of wildland-urban interface (the fires burned remote areas within Clarksburg State Forest). There are several camp sites and lean-tos within the Mount Washington State Forest land, all of which are located in areas of rugged terrain.

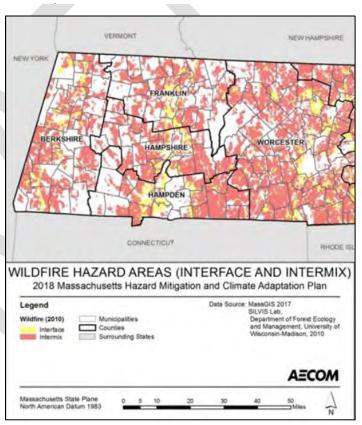
### **Geographic Areas Likely Impacted**

Mount Washington is vulnerable to fire across the Town. Old pine and spruce plantations and Christmas tree farms on the Van Der Missen Memorial Park and the Nash property are of concern given the amount of dry fuel at the sites.

Fire risk and associated damages increases where there is a mix of development and forested land. While the risk of fire is relatively low for Mount Washington compared to the Commonwealth as a whole, there is some hazard still posed by wildfire. Given increasing temperature and evaporation, drought and forest fire concerns are growing. Given predictions for increasing temperature, evaporation, and short-term periods of drought, forest fire concerns are a growing concern in rural communities. Areas where campfires or discarded burning cigarettes can start wildfires are most at risk.

The SILVIS Lab at the University of Wisconsin-Madison Department of Forest

Figure 3.29. MA Wildfire Hazard Areas (Interface and



Source: SHMCAP, 2018.

Ecology and Management classifies exposure to wildlife hazard as "Interface" or "Intermix." There are no areas designated as Interface in the Town, Intermix communities are those where housing and vegetation intermingle and where the area includes more than 50 percent vegetation and has a housing density greater than one house per 6.5 acres. Inventoried assets (population, building stock, and critical facilities) were overlaid with these data to determine potential exposure and impacts related to this hazard. Figure 3.19 shows the results of a geospatial analysis of fire risk by the Northeast Wildfire Risk Assessment Geospatial Work Group. As shown on the map, the general area of land between East and

West Streets and north of Cross Road has been designated as Intermix. This area of Mount Washington includes the main roads where homes are more frequently found, although the area is far from being densely developed.

The assessment model does not take into account hiker's overnight rest stops, where individual campfires are most likely to be created. Within the two Mount Washington State Forests block of land, long the eastern and western areas of the Town, there are several established, formal overnight sheltering sites: two lean-tos, four camp sites and one cabin. Five of these are along the AT that runs along the eastern border of the Town. All of these sites are located in rugged terrain that is difficult to access with fire trucks or tankers.

#### **Historic Data**

The wildfire season in Massachusetts usually begins in late March and typically culminates in early June, corresponding with the driest live fuel moisture periods of the year. April is historically the month in which wildfire danger is the highest. Drought, snowpack level, and local weather conditions can impact the length of the fire season (MEMA & EOEEA, 2018).

Historically small brush fires set unexpectedly by residents are the most common fires seen in Mount Washington. However, larger fires have burned here. Local officials recall stories that there was a major wildfire in Mount Washington in the 1930s. This fire originated in Connecticut and spread northward to cause extensive damage in the Town. Another fire in the summer of 2002 ago burned an area in Mt. Everett State Reservation northeast of the Summit and burned eastward into Sheffield. The fire was burned and smoldered underground for seven weeks<sup>31</sup>, extinguishing only after a sustained rain event.

More recently, in May 2021 approximately two acres of forest land was lost of fire, appearing to have been caused by a downed electrical wire at a construction site. Luckily the fire was spotted by a flight training pilot that saw smoke and directed firefighters to the fire's location. According to local news files, firefighters from at least six towns in Massachusetts and New York, as well as rescue and EMT crews, arrived at the site in approximately 30 minutes. A "massive downpour" hit the area, which helped to knock down the fire completely. Two firetrucks subsequently got stuck in mud at the scene and had to be pulled out. <sup>32</sup>Based on the DCR Bureau of Forest Fire Control and Forestry records, in 1911, more than 34 acres were burned on average during each wildfire statewide. Since then, that figure has been reduced to 1.17 acres burned annually statewide (MEMA, 2013). According to the Massachusetts Fire Incident Reporting System, wildfires reported to DCR in the past five years are generally trending downward. According to this system there were 901 fire incidents, combined urban and wildland, in Berkshire County during the years 2007-2016, and of these 411 (46% of total) occurred in the City of Pittsfield, the urban center of the region. This same data reports that a total of 832 acres

<sup>&</sup>lt;sup>31</sup> Motzkin, Orwig, Foster, 2009. Dwarf Pitch Pine Communities in the Southern Taconics: Race Mountain, Bear Mountain and "Hill 1914,", Harvard Forest Harvard University, Petersham, MA.

<sup>32</sup> Bellow, Heather, 5-27-21. "Firefighters quell 'full-fledged forest fire' in Mount Washington after pilot spots flames," Berkshire Eagle, Pittsfield,

were burned in the county during those 10 years, 631 (76%) of which are reported as acres of wildland burned. This indicates that over this 10-year span an average of 63 acres of wildland burned annually in Berkshire County. Of the 901 incidents, only 12 burned more than 10 acres and two of these burned more than 100 acres. It should be noted that during this same time period there were two large wildland fires in the county: 168 acres in Lanesborough in 2008 and 272 acres in Clarksburg near the Williamstown border in 2015. If these incidents were considered statistic outliers and removed from the data, the average totaled burned acres during 2007-2016 would be 39 and the average wildland acres burned would be 19. In 2021 a wildfire started in eastern Williamstown and quickly moved eastward across the town border into Clarksburg, consuming approximately 950 acres of forest land.

Figure 3.30. Wildfire in Clarksburg, MA 2015



Source: iBerkshires.com 2015.

Figure 3.31. Geographic area of Clarksburg Wildfire, 2015



Source: iBerkshires, 5-17-21

The Town of Clarksburg in northern Berkshire County has battled the two largest forest fires to occur within the county (2015 and 2021) since records have been kept. It is known that the 2015 fire started as a cooking fire at the Sherman Brook primitive campsite along the AT that got out of control. Forest conditions at the time were dry, a Class 4 High fire danger rating. The fire burned outward from its origins and eventually burned a total of 272 acres of forest land within the Clarksburg State Forest. According to Incident Reports filled out at the time, the fire was largely a surface fire, burning hardwood leaf litter and Mountain Laurel shrub fuel and did not become a major tree or crown fire.

The fire was difficult to fight because the site was so inaccessible and because of the rugged and steep elevations that fire fighters had to traverse to reach the fire sites. Brush trucks and tankers were not able to reach the site, so crews at first had to hike in and use back packs and portable water pumps, refilling equipment in small mountain streams.

Crews used shovels, chainsaws and leaf blowers to create fire breaks where they could. Finally, the tool that was able to really stop the fire was when DCR staff arranged to have a National Guard Black Hawk helicopter drop water on the fire, ferrying 500 gallons of water at a time from Mount Williams Reservoir in North Adams.<sup>33</sup>

<sup>&</sup>lt;sup>33</sup> Daniels, T., 5-1-15. "Clarksburg Brush Fire Contained on Third Day", as reported in iBerkshires

The 2021 East Mountain fire started on Friday, May 14<sup>th</sup> off Henderson Road in Williamstown, and by the next day had swept eastward. By the end of day on May 16<sup>th</sup> the fire had quadrupled to almost 800 acres, and by the time the fire was 90% contained on May 18th it had consumed 950 acres of land, the majority in Clarksburg. As in 2015, the fire occurred in rugged, steeply-sloped terrain that fire trucks or tankers could not access, so fire fighters and equipment had to be hauled to the sight on ATVs or, in many places where there are no trails, by foot. Firefighters accessed the site from landings in Williamstown and North Adams. More than 120 firefighters from 19 different companies and agencies in Massachusetts and Vermont battled the fire for four days, including water dropping helicopters from the state police and National Guard. Like the fire of 2015 this fire was predominantly a surface fire, burning leaf litter, twigs, branches and debris, fueled on by unusually dry conditions that officials believe are residual effects from the dry 2020 summer/fall season.<sup>34</sup> Mount Washington is unusual in that the most recent fires have been structural fires that were determined to be arson. In 1993 the main structure at the former Rich Northrop Memorial Camp burned due to arson. The loss of this structure was a critical loss that contributed to the permanent closure of the camp, which was already suffering from financial stress. During this same time, in abutting Copake, N.Y., almost 40 arsons from 1980 to 1992 terrorized that farming community and village. The fire-setters never have been caught for any of these fires.<sup>35</sup>

fire and two, those owned by the Department of Conservation and Recreation, were total losses. Among the losses was the historic Ann Lee Cottage, which was built around 1759 and was noted for hosting a 10-day stay by Shaker founder and missionary Mother Ann Lee in 1781. It was on the National Register of Historic Places. The third structure was a seasonal home, located approximately 1,200 feet from the Ann Lee Cottage, that was not occupied at the time of the arson. Although fire damage from these structural fires did not result in uncontrolled wildfires, the very low and dispersed population could allow an undetected fire to smolder and spread extensively before being reported and responded to. The fact that the Town does not have its own fire department and relies on neighboring Egremont's volunteer firefighters

In December 2019, three structures were set on fire and two those owned by the Department 2019



Source: Bellows, Heather, 12-18-19. "Big arson spree in Berkshires' smallest town: Leads surface," Berkshire Eagle, Pittsfield, MA.

to respond, with a response time of approximately 30 minutes, increases the risk that fire could spread from a structure to nearby forest lands.

<sup>&</sup>lt;sup>34</sup> Guerino, Jack, 5-17-21. "Tuesday UPDATE: Forest Fire Operation Transitioning to 'Mop Up'", as reported in iBerkshires

<sup>35</sup> Bellow, Heather, 12-18-19. "Couple escaped Nazis, found a new life in Berkshires. Enter, an arsonist," The Berkshire Eagle, Pittsfield, MA.

## **Vulnerability Assessment**

### **People**

As demonstrated by historical wildfire events, potential losses from wildfire include human health and the lives of residents and responders. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment. In 2018 MEMA and EOEEA estimated the population vulnerable to the wildfire hazard by overlaying the interface and intermix hazard areas with the 2010 U.S. Census population data. The Census blocks identified as interface or intermix were used to calculate the estimated population exposed to the wildfire hazard. Interface or intermix areas are those where buildings intermingle with forest. In Berkshire County 131,219 persons were in Wildlife Hazard Areas: 55,486 in Interface areas, and 39,171 in Intermix areas. Refer to Figure \_\_ for these areas in Mount Washington.

All individuals whose homes or workplaces are located in wildfire hazard zones are exposed to this hazard, as wildfire behavior can be unpredictable and dynamic. However, the most vulnerable members of this population are those who would be unable to evacuate quickly, including those over the age of 65, households with young children under the age of five, people with mobility limitations, and people with low socioeconomic status. Landowners with pets or livestock may face additional challenges in evacuating if they cannot easily transport their animals. Outside of the area of immediate impact, sensitive populations, such as those with compromised immune systems or cardiovascular or respiratory diseases, can suffer health impacts from smoke inhalation. Individuals with asthma are more vulnerable to the poor air quality associated with wildfire. Finally, firefighters and first responders are vulnerable to this hazard if they are deployed to fight a fire in an area they would not otherwise be in.

Smoke and air pollution from wildfires can be a severe health hazard. Smoke generated by wildfire consists of visible and invisible emissions containing particulate matter (soot, tar, and minerals), gases (water vapor, carbon monoxide, carbon dioxide (CO2), and nitrogen oxides), and toxics (formaldehyde and benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Other public health impacts associated with wildfire include difficulty in breathing, reactions to odor, and reduction in visibility. Due to the high prevalence of asthma in Massachusetts, there is a high incidence of emergency department visits when respiratory irritants like smoke envelop an area. Wildfires may also threaten the health and safety of those fighting the fires. First responders are exposed to dangers from the initial incident and the aftereffects of smoke inhalation and heat-related illness.

#### **Built Environment**

All buildings and other facilities are vulnerable to wildfire through direct impacts of burning or indirect through cut off from utilities. If any portion of a communications or and electrical systems were impacted by wildfire it would impact a portion or the entire system. Most roads would be without damage except in the worst scenarios. However, fires can create conditions that block or prevent access, and they can isolate residents and emergency service providers. The wildfire hazard typically does not have a major direct impact on bridges, but wildfires can create conditions in which bridges are obstructed as well (MEMA & EOEEA, 2018).

#### Natural environment

Fire is a natural part of many ecosystems and serves important ecological purposes, including facilitating the nutrient cycling from dead and decaying matter, removing diseased plants and pests, and regenerating seeds or stimulating germination of certain plants. However, many wildfires, particularly manmade wildfires, can also have significant negative impacts on the environment. In addition to direct mortality, wildfires and the ash they generate can distort the flow of nutrients through an ecosystem, reducing the biodiversity that can be supported. Frequent wildfires can eradicate native plant species and encourage the growth of invasive species. There are also risks related to hazardous material releases, where containers storing hazardous materials could rupture due to

Figure 3.33. Fire on East Mountain, Clarksburg, MA. Photo taken May 16, 2021 from Stop & Shop parking lot on Route



Source: Berkshire Eagle 5-18-21, "A volcanic-like glow over the Berkshires: Residents share their wildland fire photo." This photo taken by Brenda Armstrong.

excessive heat and act as fuel for the fire, causing rapid spreading of the wildfire and escalating it to unmanageable levels. In addition, these materials could leak into surrounding areas, saturating soils and seeping into surface waters to cause severe and lasting environmental damage (MEMA & EOEEA, 2018). The risk of hazardous materials releases is higher in the urban-wildland intermix and interface areas.

#### **Economy**

Wildfire events can have major economic impacts on a community, both from the initial loss of structures and the subsequent loss of revenue from destroyed businesses and a decrease in tourism. Individuals and families also face economic risk if their home is impacted by wildfire. The exposure of homes to this hazard is widespread. Additionally, wildfires can require thousands of taxpayer dollars in fire response efforts and can involve hundreds of operating hours on fire apparatus and thousands of man-hours from volunteer firefighters. There are also many direct and indirect costs to local businesses that excuse volunteers from work to fight these fires (MEMA & EOEEA, 2018).

According to the Incident Status Summary drafted by the state DCR Bureau of Forest Fire Control at the close of the Clarksburg State Forest Fire of 2015, the cost to put out that fire was estimated to be between \$20,000-30,000. This figure was for state-incurred costs and did not include locate fire company costs. The cost to the Clarksburg Fire Company was in the low thousands of dollars for food, water, equipment and other direct costs; uncompensated were the hundreds of volunteer firefighters who attended the fire and the local citizens who came to the staging area and provided food and support to the firefighters and other first responders at the scene.

### **Future Conditions**

While climate change is unlikely to change topography, it can alter the weather and fuel factors of wildfires. As noted in the Extreme Temperature section of this plan, the mean annual summer temperature in Mount Washington and the region is projected to increase. Hot dry spells create the

highest fire risk, due to decreased soil moisture and increased evaporation and evapotranspiration. While in general annual precipitation has slightly increased Massachusetts in the past decades, the timing of snow and rainfall is changing. Less snowfall can lead to drier soils earlier in the spring and possible drought conditions in summer. More of our rain is falling in downpours, with higher rates of runoff and less soil infiltration. Such conditions would exacerbate summer drought and further promote high elevation wildfires where soil depths are generally thin. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods (MEMA, 2013).

- Without an increase in summer precipitation (greater than any predicted by climate models), future areas burned is very likely to increase.
- Infestation from insects is also a concern as it may affect forest health. Potential insect populations may increase with warmer temperatures and infested trees may increase fuel amount.
- Tree species composition will change as species respond uniquely to a changing climate.

Wildfires cause both short-term and long-term losses. Short-term losses can include destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and the destruction of cultural and economic resources and community infrastructure (MEMA, 2013).

# Cybersecurity Hazards

## Hazard Profile

### **Likely Severity**

The Town of Mount Washington chose to examine the hazard of cybersecurity, which is defined as the defending of computers, servers, mobile devices, electronic systems, networks, and data from malicious attacks. The damage rendered by cybersecurity can be significant. Municipalities may see their entire system compromised by cyber-attacks, which in worst case scenarios could close down governmental operations. It could require the municipality to expend significant financial resources to recover files and possibly, in the event of ransomware attack, pay a ransom to the hacker for retrieval of files. The power outage in 2003 that caused a two-day blackout in much of the Northeast was a result of a cyberattack. This outage was related to at least 11 deaths and caused an estimated \$6 billion in economic damages over two days (Wagner, 2016). 36

## **Probability**

As computers and connectivity become more pervasive in our lives, the number of vulnerabilities increases. The frequency of attacks impacting the government has increased over the last few years, leading to a higher probability that any one entity will be attacked. In 2018, government was the 7<sup>th</sup> most targeted industry for cybercrime and experienced 8% of the total attacks. Nation-state sponsored groups are the most likely to target this sector. These groups are likely to use, sell, or deliver compromised information to their respective governments, typically for economic or political gain (IBM 2019).<sup>37</sup> The most likely reason for attacks on a community like Mount Washington is for ransom or to access personal information about residents.

Over the last three years, more than 42,000 vulnerabilities within software programs have been publicly disclosed. Vulnerabilities have increased over 5,400% in the years 2014-2019 (IBM 2019). These vulnerabilities provide more ways that criminals can access computer networks and compromise systems.

Like any organization, the greatest risk of cyber-attacks on municipal computer systems comes from the number and variety of people that work on these systems. There are a variety of factors that increase risk for municipalities.

- Varied computer literacy: Municipal staff are hired for the various skills needed to run the many governmental departments and operations within a Town, and the level of computer literacy is varied. New staff typically are screened and go through background and reference checks, but few are evaluated as to their computer habits or their ability to recognize potential security issues.
- <u>Staff turnover</u>: New staff often inherit the same desk and computer as their predecessors, and for ease in transition often inherit their usernames and passwords.

<sup>&</sup>lt;sup>36</sup> Wagner, Daniel, 2016. <a href="https://www.irmi.com/articles/expert-commentary/cyber-attack-critical-infrastructure">https://www.irmi.com/articles/expert-commentary/cyber-attack-critical-infrastructure</a>

<sup>&</sup>lt;sup>37</sup> IBM 2019 <u>https://www.ibm.com/security/data-breach/threat-intelligence</u>

- <u>Personal emails and devices</u>: For a variety of reasons, municipal staff may use their own accounts and devices for work, opening risk to municipal emails and accounts.
- Non-staff access: In addition to staff, elected and appointed board and committee members are often given access to municipal computer systems, with even less security oversight than staff.
- Limited ability to act quickly: Once a security breach has been identified, municipal staff may not be able to act quickly to contain the damage. Staff may not be trained or been given the authority to shut down systems or quickly hire consultants to help deal with the situation. If the cost of containment or ransom is high, it may require a vote of the selectboard or even Town Meeting to authorize funding to address the issue.

Cybersecurity is a constantly evolving discipline. Mitigation to reduce risk includes constant vigilance, including making sure equipment and software is up to date throughout the system. Someone in municipal government should be trained and given the responsibility for staying current with malware risk and for protecting the system as needed. Training more than one staff member will add redundancy to system oversight and maintain constant coverage. Lastly, train all municipal staff and anyone else using the system to avoid scams, malicious emails and attachments to reduce the risk of someone inadvertently allowing malware to enter the system.

## **Geographic Areas Likely Impacted**

Municipal facilities are more likely to be targeted for cybercrime, but all residents and businesses are also at risk. In addition, the electrical grid and telecommunication networks throughout the region are at risk of attacks and could result in large sections of the Town being without power or communications.

### **Historic Data**

Cyberattacks are a human-caused hazard, often spread by users who have inadvertently allowed access to their systems. In 2015 the theft of personal information of more than 22 million government employees from the computer systems of the Office of Personnel Management has far-reaching implications (Wagner, 2016). During 2016-2019, more than 11.7 billion records and over 11 terabytes of data were leaked or stolen in publicly disclosed incidents. These compromised records contain information such as social security numbers, addresses, phone numbers, banking/payment card information, and passport data. In some cases, health data may also be stolen (IBM 2019). The recent disclosure that the U.S. Pentagon and other high-ranking federal agencies had been hacked illustrates the breadth of the danger.

The recent ransomware on the Colonial Pipeline forced the closure of one of the nation's key fuel pipelines. The Colonial Pipeline is a 5,500-mile-long pipeline that carries 2.5 million barrels a day of gasoline, diesel, heating oil, and jet fuel on its route from Texas to New Jersey. Closure of the pipeline for 11 days in May 2021 prompted gasoline shortages and panic buying in the southeastern U.S., including in the nation's capital. Against the advice of its consultants and that of the FBI, Colonial paid \$4.4 million to foreign hackers to release its systems. Had the shutdown gone on longer, it could have affected airlines, mass transit and chemical refineries.

Locally, at least two towns in Berkshire County and numerous municipalities across the state have been attacked with Ransomware within the last few years. One of the towns, as advised by its insurance company, paid the ransom to get its files back. In 2016, Berkshire Health Systems, the region's central health care system that includes the county's three hospitals, numerous physician practices and clinics,

was attacked by malware. As recently as April 2021 the Massachusetts Auto Inspection System was shut down due to a cyber-attack. These attacks can cost the communities anywhere from tens of thousands of dollars to millions of dollars in ransom and countless hours restoring their systems and improving their resilience to a future attack.

## **Vulnerability Assessment**

### People

Cyberattacks rarely have direct, physical impacts on humans aside from the anguish caused by a breach. Personal identifiable information that may be stolen from a municipal system can cause disruption to people's lives, impacting their finances, security, and future. Municipal operations may be shut down during a breach, causing a delay in services, issuing permits or tax bills, or a host of other governmental functions. Cyber-attacks that impact the utilities may cause potential harm to those who rely on electricity for life support, heat, and water. Hospitals and medical facilities utilizing networked monitoring systems are vulnerable to hacking.

#### **Built Environment**

Cyberattacks on the built environment may result in the loss of power, communications and equipment failure in government offices. Attacks on the utilities would likely result in temporary loss of service, however utilities can also be attacked where the systems are taken control of and purposely overloaded, damaging the physical infrastructure, which will result in a costlier recovery and a longer recovery time. Government computer equipment can also be damaged or locked, preventing the use of that equipment unless a ransom is paid. This equipment can be replaced, but the data on the computers may not be recoverable, resulting in the loss of data and governmental records unless the computers have been properly backed up.

#### **Natural Environment**

Cyberattacks pose a threat to the natural environment as well. Systems such as wastewater or drinking water treatment plants are vulnerable to ransomware if they are connected to the internet, as hackers could control pumps, valves, chemical applications or many other parts of the systems. Chemical and other leaks from businesses can occur in the same manner. Fortunately, Mount Washington does not have any such computer- or internet-controlled systems.

#### Economy

The economy is susceptible to the threat of cyberattacks due to the loss of utilities and computers causing a reduction in economic output. Computerized control systems known as a Supervisory Control and Data Acquisition (SCADA) systems allow industries and utilities remote controlling and monitoring of industrial processes. An attach in these systems can disrupt production, shut down operations completely or otherwise damage the business' output. The power blackout of 2003 was an attack on the utility's SCADA system. The weakest link in these systems is employees unwittingly opening emails or some other back-door way into the system (Wagner, 2016). The U.S. government estimates that malicious cyber activity costs the U.S. economy between \$57 billion and \$109 billion in 2016.<sup>38</sup>

<sup>38</sup> https://www.whitehouse.gov/wp-content/uploads/2018/03/The-Cost-of-Malicious-Cyber-Activity-to-the-U.S.-Economy.pdf

#### **Future Conditions**

Continued expansion and connectivity of cyber assets will lead to a continued and growing threat to businesses, governments and individuals. Local governments will need to invest in cyber security to help mitigate the future risk of a cyber-attack. This will include upgrading computer systems, deploying security protections such as firewalls, and training users on identifying malicious activity and emails. Governments will also need to utilize professional computer staff or consultants to assist in protecting their assets and the data of their constituents.



## Landslides

## **Hazard Profile**

The term landslide includes a wide range of ground movements, such as rock falls, deep failure of slopes, and shallow debris flows. The most common types of landslides in Massachusetts include translational debris slides, rotational slides, and debris flows. Most of these events are caused by a combination of unfavorable geologic conditions (silty clay or clay layers contained in glaciomarine, glaciolacustrine, or thick till deposits), steep slopes, and/or excessive wetness leading to excess pore pressures in the subsurface (MEMA & EOEEA, 2018).

### **Likely Severity**

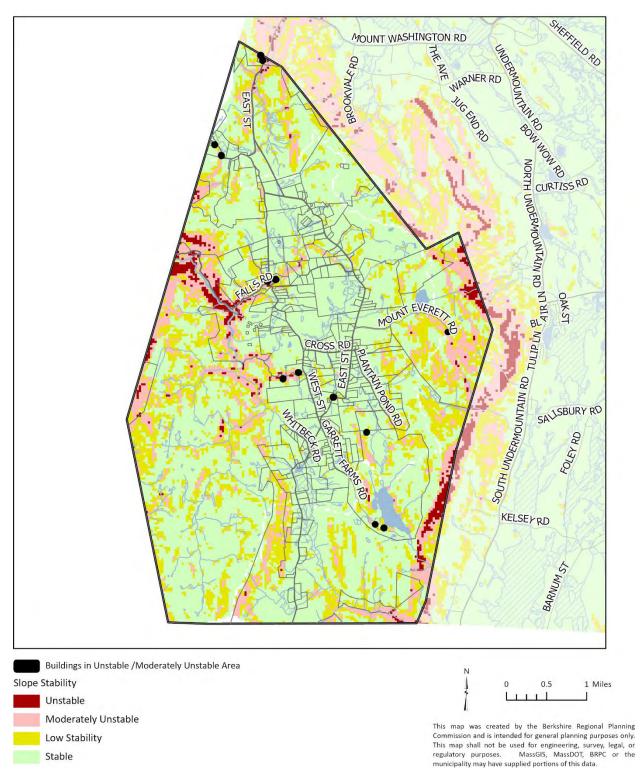
Natural variables that contribute to the overall extent of potential landslide activity in any particular area include soil properties, topographic position and slope, and historical incidence. Predicting a landslide is difficult, even under ideal conditions (MEMA & EOEEA, 2018). Estimations of the potential severity of landslides are informed by previous occurrences as well as an examination of landslide susceptibility. It is important to note, however, that landslide susceptibility only identifies areas potentially affected and does not imply a time frame when a landslide might occur (MEMA & EOEEA, 2018).

### **Probability**

For the purposes of this HMCAP, the probability of future occurrences is defined by the number of events over a specified period of time. Looking at the recent record, from 1996 to 2012, there were eight noteworthy events that triggered one or more landslides in the Commonwealth. However, because many landslides are minor and occur unobserved in remote areas, the true number of landslide events is probably higher. Based on conversations with the Massachusetts Department of Transportation (MassDOT), it is estimated that about 30 or more landslide events occurred in the period between 1986 and 2006 (Hourani, 2006). This roughly equates to one to three landslide events each year.

The probability of instability metric indicates how likely each area is to be unstable. In 2013, the Massachusetts Geological Survey prepared an updated map of potential landslide hazards for the Commonwealth (funded by FEMA's Hazard Mitigation Grant Program) to provide the public, local governments, and emergency management agencies with the location of areas where slope movements have occurred or may possibly occur in the future under conditions of prolonged moisture and high-intensity rainfall (MEMA & EOEEA, 2018). The results of this study for the Town of Mount Washington are illustrated in Figure \_\_\_\_, with corresponding map legend on the following page.

Figure 3.34. Slope Stability Map



Source: BRPC, 2021, MassGIS 2017.

Table 3.13. Landslide Ranking and Factors

Map Color Code	Predicted Stability Zone	Relative Slide Ranking <sup>1</sup>	Stability Index Range <sup>2</sup>	Factor of Safety (FS) <sup>3</sup>	Probability of Instability <sup>4</sup>	Predicted Stability With Parameter Ranges Used in Analysis	Possible Influence of Stabilizing or Destabilizing Factors <sup>5</sup> Stabilizing factors required for stability  Stabilizing factors may be responsible for stability	
	Unstable		0	Maximum FS<1	100%	Range cannot model stability		
	Upper Threshold of Instability	High	0 - 0.5	>50% of FS≤1	>50%	Optimistic half of range required for stability		
	Lower Threshold of Instability	Moderate	0.5 - 1	≥50% of FS>1	<50%	Pessimistic half of range required for instability	Destabilizing factors are not required for instability	
	Nominally Stable		1 - 1.25	Minimum FS=1	-	Cannot model instability with most conservative parameters specified	Minor destabilizing factors could lead to instability	
	Moderately Stable	Low	1.25 - 1.5	Minimum FS=1.25	-	Cannot model instability with most conservative parameters specified	Moderate destabilizing factors are required for instability	
	Stable	Very Low	>1.5	Minimum FS=1.5	15	Cannot model instability with most conservative parameters specified	Significant destabilizing factors are required for instability	

<sup>1</sup>Relative Slide Ranking—This column designates the relative hazard ranking for the initiation of shallow slides on unmodified slopes.

<sup>2</sup>Stability Index Range—The stability index is a numerical representation of the relative hazard for shallow translational slope movement initiation based on the factors of safety computed at each point on a 9-meter (~30-foot) digital elevation model grid derived from the National Elevation Dataset. The stability index is a dimensionless number based on factors of safety generated by SINMAP that indicates the probability that a location is stable, considering the most and least favorable parameters for stability input into the model. The breaks in the ranges of values for the stability index categories are the default values recommended by the program developers. <sup>3</sup>

Factors of Safety—The factor of safety is a dimensionless number computed by SINMAP using a modified version of the infinite slope equation that represents the ratio of the stabilizing forces that resist slope movement to destabilizing forces that drive slope movement (Pack et al., 2001 as cited in MEMA & EOEEA, 2018). A FS>1 indicates a stable slope, a FS<1 indicates an unstable slope, and a FS=1 indicates the marginally stable situation where the resisting forces and driving forces are in balance.

<sup>4</sup>Probability of Instability—This column shows the likelihood that the factor of safety computed within this map unit is less than one (FS<1, i.e., unstable) given the range of parameters used in the analysis. For example, a <50% probability of instability means that a location is more likely to be stable than unstable given the range of parameters used in the analysis. <sup>5</sup>Possible Influence of Stabilizing and Destabilizing Factors—Stabilizing factors include increased soil strength, root strength, or improved drainage. Destabilizing factors include increased wetness or loading, or loss of root strength

(Massachusetts Geologic Survey and UMass Amherst, 2013; Pack et al., 2001 as cited in MEMA & EOEEA, 2018).

#### **Geographic Areas Likely Impacted**

Landslides associated with slope saturation occur predominantly in areas with steep slopes underlain by bedrock or glacial till. Bedrock is relatively impermeable relative to the unconsolidated material that overlies it. Similarly, glacial till is less permeable than the soil that forms above it from organic material. Thus, there is a permeability contrast between the overlying soil and the underlying, and less permeable, unweathered till and/or bedrock. Water accumulates on this less permeable layer, increasing the pore pressure at the interface. This interface becomes a plane of weakness. If conditions are favorable, failure will occur (Mabee, 2010 as cited in MEMA & EOEEA, 2018). Occasionally, landslides occur as a result of geologic conditions and/or slope saturation. Adverse geologic conditions exist wherever there are lacustrine or marine clays, as clays have relatively low strength. These clays often formed in the deepest parts of the glacial lakes that existed in Massachusetts following the last glaciation. (MEMA & EOEEA, 2018).

Although specific landslide events cannot be predicted like a storm, a slope stability map shows where slope movements are most likely to occur after periods of high-intensity rainfall. Mount Washington is located in the Taconic Highlands Association, within the Taconic Mountains Ecoregion. The underlying bedrock in Mount Washington is granite and metamorphic rock, relatively hard materials that locally resist erosion. This creates the steep, hilly landscape with deeply incised ravines, thinly mantled by glacial till soils.<sup>39</sup> The ravines through which Karner and Bash Bish Brooks flow are examples of this type of landscape.

As noted in Figure 3.31, areas with large tracts of Unstable landscapes are found along the mountain ridgeline that is associated with Mount Everett and Mount Race, along the Town's eastern border, which coincides with extremely steep slopes. Fortunately, these areas are located within the Mount Everett State Reservation and Mount Washington State Forest, where no buildings are currently located and none are likely to be constructed. The other area where there are extensive Unstable landscapes are along Bash Bish Brook. Unfortunately, this steep valley is where the Fall Road is located, one of only two roads that provide access to residents year-round. Although less extensive in length, there are also Unstable landscapes along the East Street/Mount Washington Road corridor, the main year-round access route into Mount Washington. This is the route used by residents for services (including the local hospital) and is the emergency access route through which state and regional fire, EMS and police access the Town. Refer to Figure 3.2 for these critical areas.

#### **Historic Data**

Historical landslide data for the Commonwealth suggests that most landslides are preceded by two or more months of higher-than-normal precipitation, followed by a single, high-intensity rainfall of several inches or more (Mabee and Duncan, 2013). This precipitation can cause slopes to become saturated. In Massachusetts, landslides tend to be more isolated in size and pose threats to high traffic roads and structures that support tourism, and general transportation. Landslides commonly occur shortly after other major natural disasters, such as earthquakes and floods, which can exacerbate relief and reconstruction efforts. Many landslide events may have occurred in remote areas, causing their existence or impact to go unnoticed. Expanded development and other land uses may contribute to the

<sup>&</sup>lt;sup>39</sup> Landscape Assessment and Forest Management Framework: Berkshire Ecoregions in Massachusetts; found at https://www.mass.gov/doc/2settingpdf/download

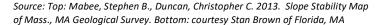
increased number of landslide incidences and/or the increased number of reported events in the recent record (MEMA & EOEEA, 2018).

The most severe landslide to occur in the Berkshire region occurred along Route 2 in Savoy during T.S. Irene in 2011 (Figure 3.33). The slide was 900 feet long, approximately 1.5 acres, with an average slope angle is 28° to 33°. The elevation difference from the top of the slide to the bottom was 460 feet, with an estimated volume of material moved being 5,000 cubic yards. Only the top 2 to 4 feet of soil material was displaced (BRPC, 2012). The soil and tree debris covered the entire width of Route 2 and caused its closure for weeks (see bottom photo left). The landslide has a significant impact on norther Berkshire County communities because Route 2 is a major east-west transportation route in that region.

Figure 3.35. Landslide in Savoy, MA along Mohawk Trail, August 2011







## **Vulnerability Assessment**

### People

Populations who rely on potentially impacted roads for vital transportation needs are considered to be particularly vulnerable to this hazard. The number of lives endangered by the landslide hazard is increasing due to the state's growing population and the fact that many homes are built on property atop or below bluffs or on steep slopes subject to mass movement. People in landslide hazard zones are exposed to the risk of dying during a large-scale landslide. For Mount Washington, damage to infrastructure that impedes emergency access and access to health care is the largest health impact associated with this hazard. Mass movement events in the vicinity of major roads could deposit many tons of sediment and debris on top of the road. Restoring vehicular access is often a lengthy and expensive process. Additionally, landslides can result in injury and loss of life.

There are 13 structures that have been identified within areas modeled as Unstable and one structure that has been identified within areas modeled as Moderately Unstable. Of these, ten are residential structures, one is on the summit of Mount Everett, and two are associated within Camp Hi-Rock. Landslide risk in the county is largely associated with prolonged rain events and heavily saturated soils, and as extreme precipitation events increase in number and severity due to climate change people living in the Unstable areas will be increasingly at risk.

#### **Built Environment**

There are ten residential structures located within Unstable areas within Mount Washington. According to data extracted from assessor parcel information, the value of all residential structures located on parcels partially or fully located within Unstable areas have a total value of \$2,652,200. This is the assessor's total value for all the many structures (homes, sheds, garages, barns, etc.) located on these parcels. It was beyond the scale of this project to try to single out the potential damage cost of the individual structures located within Unstable areas from the total valuable of all structures within each parcel. Therefore, the value calculated here for the ten individual structures located within Unstable areas is overestimated. Camp Hi-Rock has two structures located within Unstable areas. The value of all the many structures on the camp's property is valued at \$1,546,200. Like the residential cost estimation, it is not possible to single out the two individual structures from the whole, and therefore impossible to accurately calculate potential landslide damages for the two. Infrastructure located within areas shown as Unstable on the Slope Stability Map should be considered to be exposed to the landslide hazard. Highly vulnerable areas include mountain roads and transportation infrastructure, both because of their exposure to this hazard and the fact that there may be limited transportation alternatives if this infrastructure becomes unusable. Mass movements can knock out bridge abutments or significantly weaken the soil supporting them, making them hazardous for use. Access to major roads is crucial to life safety after a disaster event and to response and recovery operations. The ability of emergency responders to reach people and property impacted by landslides can be impaired by roads that have been buried or washed out by landslides. The instability of areas where landslides have occurred can also limit the ability of emergency responders to reach survivors.

The East Street/Mount Washington Road roadway is the Town's major connection to the neighboring town of Egremont, which connects residents to work and services in Berkshire County and beyond. It is the major emergency access route by which police, fire and ambulance enter the Town. As can be seen on Figure 3.33, the northern portion of East Street (Mount Washington) and Mount Washington Road (Egremont) are located on steep slopes that are categorized as Unstable. The Town's other connector,

to Copake New York, is within a ravine that is categorized as Unstable. A total of 2.45 miles of these two roads travel in Unstable zones, while an additional 0.68 miles of Mount Washington Road in Egremont are also in an Unstable zone.

Figure 3.36. Failing crib bank armoring along Falls Road Mount Washington, MA



Source: BRPC, 2021

The Falls Road travels through steep terrain, where miles of roadway are built with steeply sloped ledge on one side and a stream ravine on the other side. In the 1970s, timber cribbing has been built along the down slope to stabilize the embankments and hold the road in place. These cribs are deteriorating, as shown in Figure 3.34. The Town has not been able to secure the funding to analyze the condition of

the embankments and cribbing and offer possible stabilization solutions and cost estimates. To do so would likely cost tens of thousands of dollars, with construction likely to be in the tens of millions. Previous construction to repair approximately 1,000 linear feet of the roadway (T.S. Irene damage), without major bank stabilization, was \$1 million.

The energy sector is vulnerable to damaged infrastructure associated with landslides. Transmission lines are generally elevated above steep slopes, but the towers supporting them can be subject to landslides. A landslide may cause a tower to collapse, bringing down the lines and causing a transmission fault. Transmission faultscan cause extended and broad area outages (MEMA & EOEEA, 2018).

#### **Natural Environment**

Landslides can affect a number of different facets of the environment, including the landscape itself, water quality, and habitat health. Following a landslide, soil and organic materials may enter streams, reducing the potability of the water and the quality of the aquatic habitat Additionally, mass movements of sediment may result in the stripping of forests, which in turn impacts the habitat quality of the animals that live in those forests (Geertsema and Vaugeouis, 2008 as cited in MEMA & EOEEA, 2018). Flora in the area may struggle to re-establish following a significant landslide because of a lack of topsoil.

Figure 3.37. Mount Greylock in Adams, MA. 1990 landslide area still void of vegetation nine years later.



Source: BRPC, 1999.

## **Economy**

Direct costs of landslide include the actual damage sustained by buildings, property, and infrastructure. Indirect costs, such as clean-up costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity are difficult to measure. Additionally, ground failure threatens transportation corridors, fuel and energy conduits, and communication lines (USGS, 2003 as cited in MEMA & EOEEA, 2018). Landslides that affect farmland can result in significant loss of livelihood and long-term loss of productivity. Forests can also be significantly impacted by landslides.

#### **Future Conditions**

Increased precipitation, severe weather events and other effects of climate change affecting the region may lead to a higher likelihood for landslides as soil and vegetative cover are impacted. Maintaining access into the Town along East Road and Falls Road will be increasingly important as the population ages and the number of elderly increases. Special attention should be paid to the risk of landslide in permitting development in steeply sloped areas.

# Earthquakes

## Hazard Profile

An earthquake is the vibration of the Earth's surface that follows a release of energy in the Earth's crust. These earthquakes often occur along fault boundaries. As a result, areas that lie along fault boundaries—such as California, Alaska, and Japan—experience earthquakes more often than areas located within the interior portions of these plates (MEMA & EOEEA, 2018).

#### Likely severity

The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth. The focal depth of an earthquake is the depth from the surface to the region where the earthquake's energy originates (the focus). Earthquakes with focal depths up to about 43.5 miles are classified as shallow. Earthquakes with focal depths of 43.5 to 186 miles are classified as intermediate. The focus of deep earthquakes may reach depths of more than 435 miles. The epicenter of an earthquake is the point on the Earth's surface directly above the focus. Seismic waves are the vibrations from earthquakes that travel through the Earth and are recorded on instruments called seismographs. The magnitude or extent of an earthquake is a seismograph-measured value of the amplitude of the seismic waves. The Richter magnitude scale (Richter scale) was developed in 1932 as a mathematical device to compare the sizes of earthquakes. The Richter scale is the most widely known scale for measuring earthquake magnitude. It has no upper limit and is not used to express damage. Earthquakes above about magnitude 5.0 have the potential for causing damage near their epicenters, and larger magnitude earthquakes have the potential for causing damage over larger areas.

An earthquake in a densely populated area, which results in many deaths and considerable damage, can have the same magnitude as an earthquake in a remote area that causes no structural damage. The perceived severity of an earthquake is based on the observed effects of ground shaking on people, buildings, and natural features, and severity varies with location. Intensity is expressed by the Modified Mercalli Scale, which describes how strongly an earthquake was felt at a particular location. The Modified Mercalli Scale expresses the intensity of an earthquake's effects in a given locality in values ranging from I to XII, with accompanying descriptions of what the earthquake will feel like to people in the area. Table 3.13 describes the intensity and the equivalent Richter Scale rating.

Table 3.14. Modified Mercalli Intensity Table and Description of Impacts

Equivalent Richter Scale Magnitude	Mercalli Intensity	Abbreviated Modified Mercalli Intensity Scale Description
NA	I	Felt by very few people; barely noticeable.
< 4.2	П	Felt by few people, especially on upper floors of buildings.
NA	III	Noticeable indoors, especially on upper floors, but may not be recognized as an earthquake; vibration similar to passing of a truck.
NA	IV	Felt by many indoors, few outdoors; may feel like heavy truck striking building.
< 4.8	V	Felt by almost everyone, some people awakened; small objects move, trees and poles may shake.
< 5.4	VI	Felt by all, many frightened; some furniture moved; few instances of fallen plaster; damage slight.
< 6.1	VII	Damage negligible in buildings of good design & construction; slight-moderate in well-built ordinary buildings; considerable damage in poorly designed & constructed.
NA	VIII	Buildings suffer slight damage if well-built, severe damage if poorly built. Some walls. Chimneys, factory stacks collapse.
< 6.9	IX	Damage considerable in specially designed structures; damage great in buildings with partial collapse; buildings shifted off foundations.
< 7.3	Х	Some well-built wooden structured destroyed; most masonry and frame structured destroyed with foundations.
< 8.1	XI	Few, if any (masonry) structures remain standing; bridges destroyed.
> 8.1	XII	Damage total; objects thrown into the air.

Source: MEMA & EEA, 2018.

#### **Probability**

New England experiences intraplate earthquakes because it is located deep within the interior of the North American plate. Scientists are still exploring the cause of intraplate earthquakes, and many believe these events occur along geological features that were created during ancient times and are now weaker than the surrounding areas (MEMA & EOEEA, 2018).

A 1994 report by the USGS, based on a meeting of experts at the Massachusetts Institute of Technology, provides an overall probability of occurrence. This report found that the probability of a magnitude 5.0 or greater earthquake centered somewhere in New England in a 10-year period is about 10 percent to 15 percent. This probability rises to about 41 percent to 56 percent for a 50-year period. The last earthquake with a magnitude above 5.0 that was centered in New England took place in the Ossipee Mountains of New Hampshire in 1940 (MEMA & EOEEA, 2018). More noticeable in Berkshire County was a 5.1 earthquake centered near Plattsburg in upstate New York on April 21, 2002, which shook homes throughout the region.

Because of the low frequency of earthquake occurrence and the relatively low levels of ground shaking that are usually experienced, the entirety of the Commonwealth and the Town of Mount Washing can be expected to have a low to moderate risk to earthquake damage as compared to other areas of the

country. However, impacts at the local level can vary based on types of construction, building density, and soil type, among other factors (MEMA & EOEEA, 2018).

#### **Geographic Areas Likely Impacted**

New England is located in the middle of the North American Plate. One edge of the North American Plate is along the West Coast where the plate is pushing against the Pacific Ocean Plate. The eastern edge of the North American Plate is located at the middle of the Atlantic Ocean, where the plate is spreading away from the European and African Plates. New England's earthquakes appear to be the result of the cracking of the crustal rocks due to compression as the North American Plate is being very slowly squeezed by the global plate movements. As a result, New England epicenters do not follow the major mapped faults of the region, nor are they confined to particular geologic structures or terrains. Because earthquakes have been detected all over New England, seismologists suspect that a strong earthquake could be centered anywhere in the region. Furthermore, the mapped geologic faults of New England currently do not provide any indications detailing specific locations where strong earthquakes are most likely to be centered. Instead, a probabilistic assessment conducted through a Level 2 analysis in Hazus (using a moment magnitude value of five) provides information about where in Massachusetts impacts would be felt from earthquakes of various severities. For this plan, an assessment was conducted for the 100-, 500-, 1,000-, and 2,500-year Mean Return Periods (MRP). The results of that analysis are discussed later in this section (MEMA & EOEEA, 2018).

Ground shaking is the primary cause of earthquake damage to man-made structures. This damage can be increased due to the fact that soft soils amplify ground shaking. A contributor to site amplification is

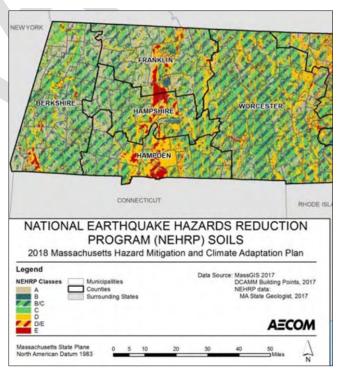
the velocity at which the rock or soil transmits shear waves (S waves). The National Earthquake Hazards Reduction Program (NEHRP) developed five soil classifications, which are defined by their S-wave velocity, that impact the severity of an earthquake.

The soil classification system ranges from A to E, where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. These soil types are shown in Figure 3.. Soil types A, B, C, and D are reflected in the HAZUS analysis that generated the exposure and vulnerability results for Berkshire County that are discussed later in the section (MEMA & EOEEA, 2018).

#### **Historic Data**

In the morning of April 20, 2002, a 5.1-rated earthquake rattled homes and work people up throughout Berkshire County. Residents describe the affects as vibrating or shaking their

Figure 3.38. NEHRP Soil Types in Massachusetts



Sources: MEMA & EOEEA, 2018; Mabee and Duncan, 2017; Preliminary NEHRP Soil Classification Map of Massachusetts

homes, rattling hangings on the wall, and sounding loud like a train or large truck passing by. According to a local news article, no injuries were reported and the only local damages reported were a cracked home foundation on Houghton Street in Clarksburg. Another earthquake in Virginia on August 23, 2011 was felt in Western Massachusetts.

In some places in New England, including locations in Massachusetts, small earthquakes seem to occur with some regularity. For example, since 1985 there has been a small earthquake approximately every 2.5 years within a few miles of Littleton, Massachusetts. It is not clear why some localities experience such clustering of earthquakes, but a possibility suggested by John Ebel of Boston College's Weston Observatory is that these clusters occur where strong earthquakes were centered in the prehistoric past. The clusters may indicate locations where there is an increased likelihood of future earthquake activity (MEMA & EOEEA, 2018).

Although it is well documented that the zone of greatest seismic activity in the U.S. is along the Pacific Coast in Alaska and California, in the New England area, an average of six earthquakes are felt each year. Damaging earthquakes have taken place historically in New England. According to the Weston Observatory Earthquake Catalog, 6,470 earthquakes have occurred in New England and adjacent areas. However, only 35 of these events were considered significant (MEMA & EOEEA, 2018).

#### **Vulnerability Assessment**

#### People

The entire population of Massachusetts is potentially exposed to direct and indirect impacts from earthquakes. The degree of exposure depends on many factors, including the age and construction type of the structures where people live, work, and go to school; the soil type these buildings are constructed on; and the proximity of these building to the fault location. In addition, the time of day also exposes different sectors of the community to the hazard. There are many ways in which earthquakes could impact the lives of individuals across the Commonwealth. Business interruptions could keep people from working, road closures could isolate populations, and loss of utilities could impact populations that suffered no direct damage from an event itself. People who reside or work in unreinforced masonry buildings are vulnerable to liquefaction.

The populations most vulnerable to an earthquake event include people over the age of 65 and those living below the poverty level. These socially vulnerable populations are most susceptible, based on a number of factors, including their physical and financial ability to react or respond during a hazard, the location and construction quality of their housing, and the inability to be self-sustaining after an incident due to a limited ability to stockpile supplies.

Hazus performed for the *Massachusetts HMCAP* estimates the number of people that may be injured or killed by an earthquake depending on the time of day the event occurs. Results were calculated on the county level. Estimates are provided for three times of day representing periods when different sectors of the community are at their peak: peak residential occupancy at 2 a.m.; peak educational, commercial, and industrial occupancy at 2 p.m.; and peak commuter traffic at 5 p.m. Table 3.14 shows the number of injuries and casualties expected for events in Berkshire County of varying severity (based on mean return periods) and for at various times of the day. Damages and loss due to liquefaction, landslide, or

<sup>&</sup>lt;sup>40</sup> Gosselin, Lisa, 4-21-02. "Earthquake Wakes up Northeast," Berkshire Eagle.

surface fault rupture were not included in this analysis. Estimated damages to the general building stock were generated at the Census-tract level.

Residents may be displaced or require temporary to long-term sheltering due to the event. The number of people requiring shelter is generally less than the number displaced, as some who are displaced use hotels or stay with family or friends following a disaster event. Shelter estimates from Hazus are intended for general planning purposes and should not be assumed to be exact. It should also be noted that, in Massachusetts, the season in which an earthquake occurs could significantly impact the number of residents requiring shelter. For example, if an earthquake occurred during a winter weather event, more people might need shelter if infrastructure failure resulted in a loss of heat in their homes. These numbers should be considered as general, year-round average estimates (MEMA & EOEEA, 2018).

Table 3.15. Estimated Number of Injuries, Causalities and Sheltering Needs in Berkshire County based upon Mean Return Period

Mean Return Period (MRP)	100	100-Year MRP			500-Year MRP			1,000-Year MRP			2,500-Year MRP		
Time of Event	2 am	2 pm	5 pm	2 am	2 pm	5 pm	2 am	2 pm	5 pm	2 am	2 pm	5 pm	
Injuries	0	0	0	4	6	4	9	13	10	22	35	25	
Hospitalization	0	0	0	0	1	1	1	2	1	3	6	5	
Casualties	0	0	0	0	0	0	0	0	0	1	1	1	
Displaced Households		0			21		51				143		
Short-Term Sheltering Needs		0		12		29			82				

Source: MEMA & EOEEA, 2018 HAZUS

#### **Built Environment**

All elements of the built environment in the planning area are exposed to the earthquake hazard. Municipal water and sewer lines could be damages or destroyed. In addition to direct impacts, there is increased risk associated with hazardous materials releases, which have the potential to occur during an earthquake from fixed facilities, transportation-related incidents (vehicle transportation), and pipeline distribution. These failures can lead to the release of materials to the surrounding environment, including potentially catastrophic discharges into the atmosphere or nearby waterways, and can disrupt services well beyond the primary area of impact (MEMA & EOEEA, 2018).

Earthquakes can damage power plants, gas lines, liquid fuel storage infrastructure, transmission lines, utilities poles, solar and wind infrastructure, and other elements of the energy sector. Damage to any components of the grid can result in widespread power outages (MEMA & EOEEA, 2018). Damage to road networks and bridges can cause widespread disruption of services and impede disaster recovery and response (MEMA & EOEEA, 2018).

Earthquakes can also cause large and sometimes disastrous landslides and wildfires. Soil liquefaction is a secondary hazard unique to earthquakes that occurs when water-saturated sands, silts, or gravelly soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, turning the ground into a pudding-like liquid. Building and road foundations lose load-bearing

strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people. Liquefaction may occur along the shorelines of rivers and lakes and can also happen in low-lying areas away from water bodies but where the underlying groundwater is near the Earth's surface. Earthen dams and levees are highly susceptible to seismic events, and the impacts of their eventual failures can be considered secondary risks for earthquakes (MEMA & EOEEA, 2018).

#### **Natural Environment**

Earthquakes can impact natural resources and the environment in a number of ways, both directly and through secondary impacts. For example, damage to gas pipes may cause explosions or leaks, which can discharge hazardous materials into the local environment or the watershed if rivers are contaminated. Fires that break out as a result of earthquakes can cause extensive damage to ecosystems, as described in Section 4.3.2. Primary impacts of an earthquake vary widely based on strength and location. For example, if strong shaking occurs in a forest, trees may fall, resulting not only in environmental impacts but also potential economic impacts to any industries relying on that forest. If shaking occurs in a mountainous environment, cliffs may crumble, and caves may collapse. Disrupting the physical foundation of the ecosystem can modify the species balance in that ecosystem and leave the area more vulnerable to the spread of invasive species (MEMA & EOEEA, 2018).

#### **Economy**

Earthquakes also have impacts on the economy, including loss of business functions, damage to inventories, relocation costs, wage losses, and rental losses due to the repair or replacement of buildings. The business interruption losses are the losses associated with the inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses of those people displaced from their homes because of the earthquake. Additionally, earthquakes can result in loss of crop yields, loss of livestock, and damage to barns, processing facilities, greenhouses, equipment, and other agricultural infrastructure. Earthquakes can be especially damaging to farms and forestry if they trigger a landslide (MEMA & EOEEA, 2018).

Table 3.15 summarizes the estimated potential building-related losses per earthquake scenario for Massachusetts. Lifeline-related losses include the direct repair cost for transportation and utility systems and are reported in terms of the probability of reaching or exceeding a specified level of damage when subjected to a given level of ground motion. Additionally, economic losses include the business interruption losses associated with the inability to operate a business due to the damage sustained during the earthquake as well as temporary living expenses for those displaced.

Table 3.16. Economic Loss Estimates, Hazus Probabilistic Scenarios

Economic Losses for Berkshire County	100-Year MRP	500-Year MRP	1,000-Year MRP	2,500-Year MRP
Building-Related Loss Estimates, Hazus Probabilistic Scenarios	\$570,000	\$25,660,000	\$66,220,000	\$200,810,000
Transportation and Utility Losses	\$170,000	\$7,800,000	\$23,180,000	\$74,200,000

Source: MEMA & EOEEA, 2018 Hazus.

#### **Future Conditions**

Earthquakes cannot be predicted and may occur at any time. Peak Ground Acceleration maps are used as tools to determine the likelihood that an earthquake of a given Modified Mercalli Intensity may be exceeded over a period of time, but they are not useful for predicting the occurrence of individual events. Therefore, geospatial information about the expected frequency of earthquakes throughout Massachusetts is not available. Unlike previous hazards analyzed in this plan, there is little evidence to show that earthquakes are connected to climate change (MEMA & EOEEA, 2018). However, there are some theories that earthquakes may be associated with a thawing Earth as the temperature increases.



#### **CHAPTER 4: MITIGATION STRATEGY**

44 CFR § 201.6(c)(3-5)

The defined mission for the Town of Mount Washington Hazard Mitigation and Climate Adaptation Plan is to reduce loss and damage to life, property, infrastructure, and the natural resources of the Town due to disaster and climate change by identifying and developing cost-effective actions to mitigate damages and loss. The Mitigation Strategy outlines how the Town of Mount Washington intends to reduce potential losses identified in the Risk Assessment chapter. The goals and objectives of the Town guide the selection of actions to mitigate and reduce potential losses. A prioritized list of cost-effective, environmentally sound, and technically feasible mitigation actions is the product of reviewing benefits and costs of each proposed project.

#### Hazard Mitigation Goals

In developing this plan, the Town of Mount Washington established the following goals for this HMCAP:

- 1. Ensure road security
- 2. Ensure fiber/communication redundancy and cyber security
- 3. Manage forests to reduce fire hazard and protect our natural resources
- 4. Manage invasive species

#### National Flood Insurance Program (NFIP)

The Town of Mount Washington is not a NFIP community. The floodplains have never been mapped nor has there ever been any Floodplain Insurance Studies conducted. It is therefore not possible to develop floodplain bylaw or join the NFIP at this time. One of the actions outlined in the mitigation strategy to complete this work in order to join NFIP.

#### **Existing Protections**

The Town of Mount Washington is fortunate in having natural mitigative infrastructure in the contiguous forests and wetland resources that dominate the landscape. The Town's undeveloped land serves as important green infrastructure performing ecosystem services including stormwater management, flood control and reduction, soil stabilization, wind mitigation, water filtration, and drought prevention amongst other benefits not easily quantified. Approximately 78% of these natural lands are permanently protected from development, being owned by the Commonwealth, The Nature Conservancy and a few private conservation deed restrictions. One study by the Trust for Public Land found that for every \$1 invested through the Land and Water Conservation Fund, there was a return on that investment of \$4 from the value of natural goods and services<sup>41</sup>. As such, partnering with state and local conservation organizations to protect and maintain the hazard mitigation functions of the Town's natural landscape is a key component in overall efforts to reduce the impacts of natural hazards and disasters on the Town's people, property and wildlife habitats.

The Town of Mount Washington has zoning in place to regulate development in the Town. Under the current Zoning by-laws no commercial properties are effectively allowed with the exception of

<sup>41</sup> http://cloud.tpl.org/pubs/benefits-LWCF-ROI%20Report-11-2010.pdf

agriculture and self-employed individuals as well as trades people (ex. carpenters, plumbers, etc.) operating out of their home with limits to space use. Minimum lot size is three acres with an additional two acres required per additional unit in a multi-family unit structure. This in combination with generous setback requirements (100 ft. in front, 50 ft. in back, and 35' on sides), limits on parking and driveway installation, and restrictions on accessory dwelling units over 600 square feet, prohibit dense development and extension impervious cover. This in turn opens more land to infiltrate precipitation. A 1999 Environmental Affairs study determined that the Town could feasibly build 1,300 more houses given the Town's Zoning By-laws and land available. The town has not grown significantly since that study, indicating the effectiveness of the by-laws on maintaining low growth. Wetlands and waterways are protected by a prohibition of building within 150 ft. of a waterbody in addition to enforcement of the Massachusetts Wetland Protection Act.

Wetland resource areas are partially protected from adverse development impacts through the Massachusetts Wetlands Protection Act (310 CMR 10.00), one of the most protective wetlands laws in the U.S. Under the Wetlands Protection Act no one may "remove, fill, dredge, or alter" any wetland, floodplain, bank, land under a water body, land within 100 feet of a wetland, or land within 200 feet of a perennial stream or river, without a permit from the local Conservation Commission. The Act identifies several presumed "interests" or values to be protected: flood control, prevention of storm damage, prevention of pollution, and protection of fisheries, shellfish, groundwater, public or private water supply, and wildlife habitat. The term "alter" is defined to include any destruction of vegetation, or change in drainage characteristics or water flow patterns, or any change in the water table or water quality. The wetland regulations prohibit most destruction of wetlands and naturally vegetated riverfront areas and require replacement of flood storage loss when floodplains are filled. The Act is locally administered by the Mount Washington Conservation Commission.

It is difficult to properly regulate floodplains in Mount Washington because in the Act the 100-year floodplain is defined as "the boundary of Bordering Land Subject to Flooding is the estimated maximum lateral extent of flood water which will theoretically result from the statistical 100-year frequency storm. Said boundary shall be that determined by reference to the most recently available flood profile data prepared for the community within which the work is proposed under the National Flood Insurance Program." Because there is no NFIP map, there is no clear delineation or presumption of floodplain borders.

Additionally, the Massachusetts Building Code (780 CMR 1.00-36.22) has some of the most stringent building code standards in the country, including construction within flood zone or floodplains, and this code has been adopted by the Town of Mount Washington as its minimum building standards. Local municipal building inspectors must be certified by the state to be eligible for the position.

According to Massachusetts Office of Dam Safety, dam owners are required to inspect and report results every 2 years for High Hazard Potential dams, every 5 years for Significant Hazard Potential dams and every 10 years for Low Hazard Potential dams. Most dams with few exceptions follow this inspection schedule and reporting inspection reports to DCR as required. Plaintain Pond Dam is the only dam classified as a Significant Hazard and as such has a current Emergency Action Plan on hand available both to the owners, The Nature Conservancy, the Town, the Town of Sheffield, and the YMCA Camp Hi-Rock Director. Only one dam is found to be in Poor conditions, Becker Pond Dam. This dam is slated to be removed by The Nature Conservancy in partnership with Massachusetts Dept. of Ecological Restoration.

The Mount Washington Highway Department is a small but dedicated crew of two staff, working under challenging financial constraints to maintain the road system throughout the Town. Staff frequently inspect culverts and bridges to ensure that they are clear of debris. The Highway Superintendent works in the field with his crew member and is aware of road conditions. There are several areas where upsizing culverts should be undertaken, but outside funding is needed to bring them up to state stream crossing standards.

Table 4.1. Summary of Existing Protections – Mount Washington

Type of Existing Protection	'Description	Area Covered	Effectiveness	Improvements Needed
Building Code	The town enforces the state building code	Entire town	Effective	None
Zoning By-laws	Zoning by-laws restrict excess growth and impervious cover	Entire town	Effective	None
Collaboration with the DCR, the Nature Conservancy, and regional conservation efforts	Utilize strong communication regionally to encourage collaboration across conservation efforts.	Mt. Everett State Reservation, Mt. Washington Reservation, Mount Plaintain Preserve, Sages Ravine, Schenob Brook, TNC Easements	Somewhat Effective	None
Stormwater System	The town has a system of stormwater control.	Entire town	Somewhat effective	Replace/maintain drainage system where flooding occurs.
Tree Trimming	The town is working with the utility companies to increase communication on efficiently trimming trees.	Majority of town	Effective	None
Ditch maintenance	The town regularly maintains their system of ditches.	Entire town	Effective	None
Catch Basin Maintenance	The town regularly maintains their catch basins.	Entire town	Effective	None
Replacement of Small Culverts	The town has replaced culverts that are too small and/or are old boilers over the last few years.	Entire town	Mostly Effective	None
Emergency Response	The town contracts with Egremont Fire Department for all emergency responses.	Entire town	Mostly Effective	None

In many of the wetland areas, beavers are abundant and provide ecosystem services controlling flood waters. Where beavers pose a threat to human health and safety, the Town Board of Health oversees

emergency permits to trap and remove beavers pursuant with Massachusetts General Law Chapter 131 §80A.

The Department actively pursues state funding for road, bridge and culvert upgrades and replacements, despite the fact that the odds are stacked against small towns such as Mount Washington in receiving priority state highway funding. Demands for state and federal highway funding has for decades far outpaced the annual allocations given to the Berkshire County region. As a result, worthy road improvement projects languish on the regional Transportation Improvements Project list for years, sometimes decades. Most recently, the Town received funding for a dirt/gravel roads survey which was completed in August 2020. Mount Washington applied to MassWorks to complete comprehensive maintenance on 7.2 miles of the worst gravel roads.

The Highway Department has a long history of monitoring and trimming or taking down trees that threaten utility lines or safe travel. In 2021 the crew was slated to remove 100 ash trees overcome by invasive pests. The annual budget for tree maintenance is \$18,000 but given the growing need, the Highway Department has made a push to double this budget in the coming year.

The Mount Washington Police Department's primary responsibility is the issuance and renewal of gun permits. The Acting Chief of Police completes a background check, mental health check, and confirms that fingerprints are on file for each applicant. The police department plays no active role in policing or crime enforcement. Rather, the Acting Chief liaises with the Massachusetts State Police at the Lee Barracks regarding any criminal matters and works with other state policing agencies regarding public safety responses. The response time for policing requests depends on where the nearest state police officer may be at the time of the Town's request. Support from the Acting Chief and from Senior Police Officer David Whitbeck is often provided in search and rescue of lost or injured hikers and other outdoor recreationists

#### Strengths and Challenges

As part of the hazard mitigation planning process, the Town conducted a self-evaluation of its policies, regulations, operations, and emergency preparedness. The Town used as its guide the Capability Assessment Worksheet tool found within FEMA's *Local Mitigation Planning Workbook* of 2013. Additionally, one-on-one interviews were held with key Town officials, department heads and first responders, and with the Executive Director of Camp Hi-Rock.

One of the main strengths of the Town is the independent spirit and resilience of its residents. Winters are generally harsher and longer here than in the valley towns below, and wind and ice damages are generally more severe. Services such as stores, fuels or medical care are many miles away, and those who live here are generally equipped to shelter in place if necessary. Also, residents here have a willingness to work together during emergency situations. The population of the Town is small enough that people know their neighbors. Neighbors are generally aware of where the small number of vulnerable residents live, such as the elderly or those with medical conditions, and they check in on them during severe storms or when electricity is out. Council on Aging maintains a contact list of seniors and those in need and utilizes this list for emergency outreach when needed.

Although the Town and its residents are resilient in the face of routine severe storms, true resiliency was shown during IRENE 2011. While roads and driveways were washing away, and all emergency routes out of town suffered severe damages, town staff and residents were all hands-on-deck. The Town Highway

Crew repaired roads with an excavator and blocked off roads that were unpassable. Emergency Management Director, Assistant Emergency Management Director, and local worked tirelessly to make sure roads were open, clearing trees and debris where needed for days and weeks following the storm.

Due to its rural nature, Berkshire County is a region where small towns routinely share experiences, resources, and services. Formal mutual aid agreements for first responders are in place, providing regional services beyond the capacity of a small town such as Mount Washington. The Town has a standing agreement with the Egremont's Fire Department in which the two towns share a Fire Chief and emergency services. This agreement while long-standing has come under scrutiny with the retirement of the past Fire Chief who used lived in Mount Washington and thus had a commitment to the Town. Mount Washington has been active in trying to address services and costs for emergency services through negotiation with Egremont. For ambulance support, Mount Washington relies on Southern Berkshire Volunteer Ambulance service out of Great Barrington. There has been some discussion about dissolving this entity as Great Barrington seeks to create their own ambulance service — an action that would leave Mount Washington without ambulance services entirely. However, this has not progressed and there is wide support for the nonprofit to continue to assist the six Southern Berkshire towns that rely on it.

Mount Washington is one of the most rural areas in the county, with no businesses or public services offered in the Town. To aid new residents in adjusting to rural living conditions the Town has developed a New Residents / Important Links section on its website that is featured on the Home Page. Within this is a Welcome page that explains the limited services that the Town offers (Broadband, trash/recycling, mail delivery, school registration, etc) and directs new residents to nearby public services (businesses, hospital, etc.). While this section is informative, it does not take the opportunity to provide links to key weather stations or emergency alert systems or inform new residents about at-home emergency preparedness. Educating residents about potential natural hazard events and helping them prepare to shelter in place for extended periods of time would expand the usefulness of this Welcome section.

Other areas of great concern are unpaved roads that become dangerous or impassible during wash outs caused by severe storms or during freeze/thaw events and mud season. In general, the Town has been experiencing an increase in the number of freeze/thaw events per year for the past several years, leading to more and longer periods where some roads become impassible to all but very hardy vehicles. For local residents who have lived on these roads for years or decades, mud season is considered as something that has to be endured each spring, where there are periods of time where the roads are impassible and/or closed. In recent years freeze/thaw cycles have become more frequent and severe due to periods of warmer weather, making life more inconvenient for them. Educating newcomers about rural living and how to prepare for and endure periods of isolation, i.e. sheltering in place, was raised as an issue.

Despite its small size, Mount Washington has had some success in securing grants for road improvement. For example, the Town was able to secure a \$1.1 million MassWorks Grant to repair and reconstruct Falls Road, which was damaged as a result of T.S. Irene. The Town was most recently successful in being awarded \$310,500 in STRAP grant funding to remediate the gravel segments of East and West Streets, to be spent over a period of three years. Funds will be spent on culvert repair and replacement, improved drainage and new construction.

As of 2021 the Mount Washington Broadband Network (MWBN) is into its fourth year of successful operations that include internet coverage for 137 subscribers, which accounts for 88% of the Town's

residential and municipal structures. Mount Washington was one of the first towns in the Berkshires to install fiber optic network to provide the Town with a dedicated super-fast internet connection. The Town manages the network internally through a Broadband Committee that contracts with telecommunications companies to provide customer service, technical support, and network maintenance and repair. Telephone service is also provided over the fiber optic network. Until recently there was very limited cell phone service, however this recently changed with the installation of a cell tower in Salisbury, CT that covers much of the Town. However, most residents rely on VoIP system for communication.

One of the region's greatest challenges is drawing and retaining volunteers for town offices and committees. Decreasing volunteerism in fire and ambulance companies is a common issue across the region and the U.S., due to a variety of trends, among them:

- An increasing elderly population in the county: this increases demand for emergency response.
- Volunteers are aging out: many current volunteers are retiring from their volunteer fire and ambulance positions.
- Economic trends: two-income families are the norm, leaving less free time for volunteerism.
- Increased trainings: there are ever-greater demands for achieving and maintaining fire and medical training and certification, a burden for those with limited time to volunteer.
- Social trends: the able-bodied population of today generally has less time and capacity to volunteer.

Because the Town has such a small tax base, pulling together funding for large, costly projects is difficult and often takes years to secure. As climate change is expected to increase the frequency and intensity of severe storm events, it will be important for the Town to be able to prepare for and maximize its competitiveness for regional, state, and local funding sources.

The Town of Mount Washington is too small to employ a technical staff (e.g. Community Planner, Civil Engineer, etc.) and turns to Berkshire Regional Planning Commission for technical assistance in a variety of disciplines, including data collection, zoning and energy planning, public health and grant writing. Local engineering firms and other technical advisors are hired as needed.

The Town of Mount Washington has developed few formal planning documents or protocols. A Master Plan was completed in 1998 but otherwise does not have an economic development plan, or future land use strategy and map. The Town does not have local "Safe Growth" policies or regulations in place to steer development away from hazard areas, however the zoning requirements curb this need somewhat. While the Mount Washington Conservation Commission can protect wetland and riverfront resources under the state's Wetland Protection Act, and the Planning Board prohibits building within 150 feet of a waterbody, the Town is not able to properly regulate development within floodplain areas because these areas have never been delineated for any portion of the Town. The Town has developed a policy for new driveway cuts, where the highway superintendent visits the site to see if mitigation may be needed to avoid runoff from new homes and driveways. This does not address existing issues with driveway runoff and washouts, but it is an attempt to avoid past mistakes.

Camp Hi-Rock has a nurse on staff for minor injuries and sickness while youth are present. For more major procedures, the Camp connects with local hospital. This may include rattlesnake bites which are more present in Mount Washington. The Camp has Emergency Action Plan in addition to the Town's.

#### **Prioritizing Actions**

Actions are categorized within primary *Mitigation Types*:

- Local plans and regulations
- Structural projects
- Education, preparedness, and response
- Natural resource protection

Description of Action is the brief summary of the mitigation action the community has identified to reduce their vulnerability to a hazard or more broadly increase resilience.

Benefit explains what the action mitigates or how it to increase resilience.

*Implementation Responsibility* will reflect ownership and/or jurisdiction of a facility or action that will be mitigated or otherwise receive funding for improved resilience.

*Priority* of a project is High or Medium, determined by factors including conditions due to disaster events and recovery priorities; local resources, community needs, and capabilities; State or Federal policies and funding resources; hazard impacts identified in the risk assessment; development patterns that could influence the effects of hazards; climate change implications, and partners that have come to the table.

Timeframe is listed at Short, Medium, Long, and Ongoing to reflect the timeframe identified for projects through the MVP Community Resilience Building process. A project that has been identified as short term is one that can be implemented within the next 1-3 years. These projects are likely to have a favorable benefit-cost outcome, have the political and community support necessary, and are practicable. Medium timeframes can be implemented in 3-5 years. Long term projects require multiple steps before implementation, including studies, engineering, and gaining community support, a timeframe that's expected to take between 5 and 10 years. Ongoing projects are those that may be implemented immediately but will require constant investment of resources for maintenance or other project requirements such as education.

Cost was estimated and categorized as follows:

**High:** Over \$100,000

Medium: Between \$50,000 - \$100,000

**Low:** Less than \$50,000

N/A: For some projects, cost is not applicable

Resources and Funding for each action are known or potential technical assistance, materials and funding for the type of project identified.

Table 4.2 provides a roadmap for the Town of Mount Washington to increase resiliency and will be updated with the new plan in five years.

Table 4.2. Mitigation Action Plan for the Town of Mount Washington

Actions in italic font are from the 2012 plan. New actions and updates are listed in regular font.

Category of Action	Description of Action	Implementation Responsibility	Timeframe / Priority	Cost	Resources / Funding	Notes/ Updates from 2012
Structural Project – Bank Stabilization	Perform engineering study of Northern Mt. Washington Road embankment. "Sally's Cradle	Town of Mount Washington	1-3 years / High	High	FEMA and Town Capital Improvements	No update
Structural Project	Perform engineering study on Bash Bish Falls Road.	Town of Mount Washington	1-3 years / High	Medium	FEMA and Town	Town procured engineering design and secured funding to repair the damage from Hurricane Irene. The Town was finally successful in obtaining a STRAP grant to help fund construction. New funding is needed to address bank erosion and find long term sustainable solutions and fix cribbage.
Prevention - Flooding	Work with Conservation Commission and DEP to improve ability to remove debris from streams where flooding is a concern.	Town of Mt. Washington	Ongoing / Low	Low	Town Budget	Shift in focus for conservation committee to look at flooding and water quality more broadly in the actions below.
Natural resource protection	Develop plan to educate private property owners about the importance of preserving and keeping our wetlands intact.	Town of Mt. Washington Conservation Commission	Long / Medium	NA	Town Conservation Commission	New Project

Local plans and regulations	Develop stormwater infrastructure plan that emphasizes green infrastructure and nature-based solutions, update drainage infrastructure where necessary.	Town of Mount Washington	Long / Medium	Medium	EOEEA MVP Action Grant, MassDEP 604b and 319 Grant Program, FEMA BRIC	New Project
Education, preparedness, and response	Encourage maintenance of dams throughout town.	Private and DCR Properties	Ongoing / Low	Low - High	EOEEA Dam and Seawall Grants	New Project
Education, preparedness, and response	Provide outreach materials on how to manage beavers.	Town of Mount Washington Board of Health	Ongoing / Low	Low	Town Board of Health	New Project
Local plans and structural projects	Develop plan for replacing culverts that addresses environmental impacts and maintenance of existing culverts.	Town of Mount Washington Highway Dept.	Long / High	High	EOEEA MVP Action Grant, DER Municipal Culvert Replacement Grant Program, FEMA BRIC	Town has completed a gravel roads survey in 2020 which included cross drainage. A list of culverts and cost estimates were included for replacement as part of road work. Follow-up includes funding to complete road work.
Local plans and structural projects	Develop comprehensive plan to manage roads and stormwater infrastructure.	Town of Mount Washington	Ongoing / High	High	EOEEA MVP Action Grant, FEMA BRIC C&CB Program	New Project
Structural projects	Continue to manage trees near rights-of-way where internet, phone, electrical wires are located.	Town of Mount Washington	Short / High	Medium	Town Highway Dept. Budget, Utility	Town Highway Dept. and Utility continues to manage trees for possible power outages.
Structural projects	Explore increased redundancy of internet and phone system.	Town of Mount Washington	Medium / High	Medium	Massachusetts Community Compact IT Grant	New Project
Education, preparedness, and response	Continue and enhance local phone tree for emergency situations.	Town of Mount Washington	Short / High	NA	Town Emergency Manager and Council on Aging Budget	New Project

Structural project	Bury power lines and broadband cable where possible.	Town of Mount Washington and Utility Companies	Long / Low	High	FEMA Hazard Mitigation Grant Program	New Project
Local plans and regulations	Develop long-term invasives management plan.	Town of Mount Washington Invasives Committee, The Nature Conservancy, DCR, and regional Conservation	Long / High	Medium	NFWF New England Forests and Rivers Grant	New Project
Structural project	Explore and seek funding building a new highway garage with a washing bay and emergency supplies storage	Town of Mount Washington Highway Dept. & Invasives Committee	Short / Medium	High	EOEEA Grants and Technical Assistance, Town Capital Improvement Budget	New Project
Natural resource protection	Educating municipal and private property owners about the benefits of buffer plantings and stream restoration along all streams in town.	Town of Mount Washington Conservation Commission, Land Trusts	Ongoing / High	Low	Town Conservation Commission, MassDEP 604b/319 Grant	New Project
Local plans and regulations	Partner with interested entities to develop comprehensive natural resources management plan	Public, Town, neighboring towns, TNC, BNRC, DCR	Medium / Ongoing	Medium	Conservation Assistance for Small Communities Grant, Landscape Partnership Program	New Project
Natural resource protection	Explore installing groundwater monitoring wells to determine current levels and changes over time.	Town of Mount Washington	Long / Medium	Medium	MVP Action Grant, Drinking Water Supply Protection Grant Program,	New Project

Natural resource protection  Local plans and	Educate homeowners on runoff/sediment issues and establish monitoring and reporting protocol for residents that notice new runoff/sediment issues.  Consider update zoning	Town of Mount Washington	Ongoing / High	Low	Conservation Assistance for Small Communities Grant  Conservation	New Project  New Project
regulations	regulations for residential driveway drainage to redesign/redirect runoff away from wetlands.	Washington	High		Assistance for Small Communities Grant	
Natural resource protection	Research grant support for training opportunities for Conservation Commission and DPW	Town of Mount Washington Conservation Commission	Short / Low	Low	Conservation Assistance for Small Communities Grant	New Project
Education, preparedness, and response	Encourage DCR and other public lands owners to manage and enforce rules regarding public use of water areas (i.e. swimming).	DCR and Land Trusts	Long / High	Low	DCR Budget	New Project
Education, preparedness, and response	Encourage state and other public landowners to educate residents and visitors on safety protocols and environmental stewardship and increase management/oversight of public places.	DCR and Land Trusts	Ongoing / High	Low	DCR and Land Trusts Budget	New Project
Local plans and regulations	Develop emergency action/fire management plan that addresses protecting public areas.  Continue to work with the Department of Conservation & Recreation to ensure the reduction of excess dry	Van Der Smissen Memorial, DCR, Town of Mount Washington	Medium / High	Medium - High	FEMA Fire Prevention and Safety Grant	Mount Washington has an ongoing relationship with both Van Der Smissen Memorial and DCR to manage fire. Next steps are to procure funding to develop a townwide Fire manage plan as the new project.

Education, preparedness, and response	timber in the Mt. Greylock Reservation area. Vandersmissen Park on Hatchhill St. will establish break points for fire lanes. Town sponsor/host a talk/speaker series on this topic to better inform residents on how we can	Town of Mount Washington, Egremont Fire Dept.	Ongoing / Medium	Low	FEMA Fire Prevention and Safety Grant	New Project
	assess and plan for this hazard.					
Education, preparedness, and response	Increase recruitment of Mt. Washington residents to volunteer for emergency response services and fire department.	Town of Mount Washington, Egremont Fire Dept.	Ongoing / High	Low	FEMA Emergency Management Performance Grant	New Project
Local plans and regulations	Review and update emergency management plan.	Town of Mount Washington	Medium / Medium	Medium	FEMA Emergency Management Performance Grant / Medium	New Project
Education, preparedness, and response	Continue communication/sharing resources between neighboring towns. Outreach and education on emergency preparedness	Town of Mount Washington	Ongoing / Medium	Low	FEMA Emergency Management Performance Grant	New Project
Education, preparedness, and response	Educate residents on what on what emergency resources currently exist. Encourage signups Blackboard Connect through Town website	Town of Mount Washington Emergency Management Director	Short / High	NA	Town Emergency Director & Council on Aging	New Project
Education, preparedness, and response	Encourage the organization of events designed to bring people together and build sense of community	Town of Mount Washington, Council on Aging, Residents	Short / Medium	NA	Town Residents	New Project

Education, preparedness, and response	Continue to publicize what volunteer positions are needed in town.	Town of Mount Washington	Long / Medium	NA	Town	New Project
Education, preparedness, and response	Educate live-in caregivers how to handle emergency situations in Mt. Washington.	Town of Mount Washington, Egremont Fire Dept.	Short / Medium	Low	FEMA Emergency Management Performance Grant, Council on Aging	New Project
Education, preparedness, and response	Encourage collaboration with public landowners to increase staffing and management to accommodate increased traffic, visitor use, safety, and park management.	DCR, Land Trusts, Mount Washington	Long / High	Low	DCR & Land Trusts Outreach Budgets	New Project
Education, preparedness, and response	Increase advocacy, communication, and collaboration with stakeholders and other towns that have similar conservation and preparedness issues.	Town of Mount Washington	Long / High	Low	MVP Action Grants	New Project
Education, preparedness, and response	Identify what is most needed in town and skills associated with needs; hire new staff to help where needed and solicit residents for skills that may be helpful.	Town of Mount Washington	Ongoing / Low	Low	MA Community Compact Grant	New Project
Local plans and regulations	Encourage new buildings to be more sustainable (use less fuel) and self-sufficient.	Town of Mount Washington	Ongoing / Low	Medium	DOER Green Communities, Community Compact Best Practices Grant	New Project
Local plans and regulations	Explore grants and programs that help town with energy reduction technologies to help municipal buildings.	Town of Mount Washington	Ongoing / Low	Low	DOER Green Communities, Community Compact Best Practices Grant / \$20,000	New Project

Through a public process and open listening sessions, the Hazard Mitigation and Municipal Vulnerability Preparedness core team developed four main priorities which include:

#### Natural Resource Management

- Partner with interested entities to develop comprehensive natural resources management plan
  that includes old growth forest inventory, assessing regulations, strengthening collaboration and
  partnerships, identification of methods for maintaining biodiversity, and educating
  residents/visitors on the importance of forest/water resources (drinking water that Mt.
  Washington supplies to surrounding areas) and best management practices for reducing impacts
  to these important resources.
- Explore installing groundwater monitoring wells to determine current levels and changes over time.

#### Stormwater Management

- Develop plan for replacing culverts (undersized, made of metal, old, failing) that addresses environmental impacts (flooding) of rightsizing along with developing a maintenance plan for existing culverts. Consider incorporating protocol where residents monitor known problem areas (ensure those areas are checked after storms) and report changes/problems to the Town.
- Educate homeowners on runoff/sediment issues and establish monitoring and reporting protocol for residents that notice new runoff/sediment issues.
- Consider update to zoning regulations for residential driveway drainage to redirect runoff away from wetlands.
- Research training opportunities for Conservation Commission and Town Highway to receive additional training with grant support.

#### Roadways

- Develop comprehensive plan to manage roads, especially dirt roads, that incorporate efforts to
  improve ditching and drainage, mitigate runoff and sedimentation, improve/look at alternatives
  for retaining walls, and formalizes protocol for regular cleaning of catch basins. Plan should
  explore access to external funding sources and what other towns have done to mitigate the
  effects of water on dirt roads (turning the roads to mud) along with other best management
  practices.
- Comprehensive management plan can also incorporate an exploration of technological/material solutions that would make roads less vulnerable to freeze/thaw cycles.
- Comprehensive management plan should address vehicle weight limits (increase signage, etc.), and reconstruct/rebuild roads near streams.
- Continue to ensure evacuation route is maintained.
- Continue to maintain open lines of communication with neighboring Towns as per Mt.
   Washington's Emergency Management Plan.

#### Wildfires

- Develop emergency action/fire management plan that addresses protecting public areas, fire breaks, culling/removing fire fuel (including addressing overgrown Christmas trees), acquiring technical assistance to implement and issue fire hazard alert levels on town website, guiding homeowners on how to protect homes, updated fire management tools and methods, and clarifies fire management practices on state properties. Conduct tabletop exercise.
- Town sponsor/host a talk/speaker series on this topic to better inform residents on how we can assess and plan for this hazard.
- Encourage residents to volunteer for emergency response services and fire department that serves Mt. Washington.



#### **CHAPTER 5: PLAN ADOPTION**

44 CFR § 201.6(c)(5)

This Plan received official Approval Pending Adoption from FEMA on DATE and was formally adopted by the Mount Washington Select Board on DATE. Subsequently it received final approval from FEMA on DATE.



#### **CHAPTER 6: PLAN MAINTENANCE**

44 CFR § 201.6(c)(4)

44 CFR § 201.6(c)(4) asks for a section of the HMCAP to describe the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle, process by which Mount Washington will incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate, and how the community will continue public participation in the plan maintenance process (44 CFR § 201.6(c)(4)(iii)).

## Plan Review and Updates §201.6(c)(4)(i) (iii)

The Town of Mount Washington will officially review needed updates for the plan on an annual basis. Specifically, the Hazard Mitigation and MVP Planning Committee, stakeholders, and partners will maintain and update the mitigation action tables, complete site visits and produce reports of completed or initiated mitigation actions to incorporate into the next plan revision, research and document new disaster information, and participate in resiliency- and mitigation-related initiatives available to the region.

Bi-annual review is scheduled to occur once this HMCAP has been approved by FEMA. Under the leadership of the Select Board members and the Hazard Mitigation/MVP Planning Committee, the Town will track updates based on completed mitigation actions, new development, changing problem areas, and input from public involvement. As needed on an annual basis, these updates will be shared with BRPC, which maintains a county-wide GIS data.

In reaching out to the residents and neighbors of Mount Washington, the Hazard Mitigation Planning Committee began building a network of interested residents that can enhance the next update. While the Hazard Mitigation Plan must be updated every five years, Mount Washington will begin the process of organizing and identifying funding for the plan update 1.5 years before this plan expires. Recommendations listed in the FEMA Review Tool (following page) will be considered.

## Integration in Future Planning §201.6(c)(4)(ii)

This HMCAP will be used in all future planning efforts in Mount Washington including comprehensive plan updates, transportation plans, and zoning changes.

The final adopted HMCAP will be made publicly available on the Town of Mount Washington website for reference and comment. Any regional plans developed by BRPC or the Commonwealth should refer to the publicly available Mount Washington Hazard Mitigation and Climate Adaptation Plan to ensure consistency with the vision for community resilience to hazards.

FROM SECTION 2 OF THE LOCAL MITIGATION PLAN REVIEW TOOL ISSUED BY FEMA, Dated

PLAN ASSESSMENT – INSERT FEMA FINAL COMMENTS HERE

**A. Plan Strengths and Opportunities for Improvement.** This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

#### **Recommended Corrections:**

• N/A

#### Major References:

Berkshire Regional Planning Commission (BRPC), 2012. *Berkshire County Hazard Mitigation Plan*, Pittsfield, MA.

BRPC, 2015. Berkshire County Hazard Mitigation Plan Addendum: Towns of Clarksburg, Hinsdale, Mount Washington, & New Ashford, Pittsfield, MA.

Commonwealth of Mass., 2021. Resilient MA Climate Clearinghouse website, <a href="https://resilientma.org/">https://resilientma.org/</a>. This website hosts relevant data used throughout this plan, including the NE CASC data.

Mass. Emergency Management Agency (MEMA) & the Exec. Office of Energy and Environmental Affairs (EOEEA), 2013. *Massachusetts State Hazard Mitigation Plan (SHMP)*, Boston, MA.

Mass. Emergency Management Agency (MEMA) & the Exec. Office of Energy and Environmental Affairs (EOEEA), 2018. *Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP)*, Boston, MA.

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Resilient MA Climate Change Clearinghouse for the Commonwealth, resilientma.org, 2021.

## APPENDIX A: PUBLIC PARTICIPATION & SURVEY RESULTS

TO BE ADDED WITH FINAL PLAN



# APPENDIX B: COMMUNITY RESILIENCE BUILDING WORKSHOP



# Mount Washington, Massachusetts

Municipal Vulnerability Preparedness (MVP), Community Resilience Building Workshop: Summary of Findings

June 2022





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## **Overview**

#### Introduction

The need for municipalities to increase resilience and adapt to extreme weather events and natural hazards is becoming more evident among the communities in Berkshire County, Massachusetts. Responding to this need, the Town of Mount Washington pursued the Municipal Vulnerability Preparedness (MVP) program in conjunction with their Hazard Mitigation Planning process.

The Town of Mount Washington spans a 22.39 square mile area and is situated at the southwestern edge of Berkshire County and the State. The Town is bordered by Egremont to the north, Sheffield to the east, Salisbury, Connecticut, to the south, Ancram, New York to the southwest, and Copake, New York to the west. Located within the Taconic Mountain range with Mount Everett to the east and Alander Mountain to the west, Mount Washington is secluded, having only three roads that lead out of town, and only one, East Street, that connects to the rest of Massachusetts through Egremont. Bash Bish Falls State Park, Mount Everett State Reservation, and Mount Washington State Forest are located within the town's borders and serves as a popular natural attractions for residents and tourists alike.

The town has an estimated population of 136<sup>1</sup>, giving a density of approximately 6 people per square mile. There are 65 total households, resulting in a household size of approximately 2 people per household. The median age of town residents is 57.5 years of age, which is about 10 years older than the median age of Berkshire County residents.<sup>2</sup> According to MassGIS land use data, the predominate land uses in town are forest (93%), open water and wetland (3%), residential (1.9%), and agriculture (1.2%).<sup>3</sup>

#### Community Resilience Building Workshop

During the winter of 2022, Mount Washington began a joint planning process to create the Town's first independent Hazard Mitigation Plan and to develop a MVP Plan. Prior to this the Town was included in a Berkshire County regional plan. Grants from Federal Emergency Management Agency (FEMA) through the Massachusetts Emergency Management Agency (MEMA) and from the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) made this comprehensive mitigation and climate change planning process feasible.

The town formed a Hazard Mitigation / Municipal Vulnerability Preparedness Committee to steer the process. Members of the Committee include municipal department heads and representative from various town boards and committees from several disciplines, along with representatives of key community stakeholders.

The town retained the Berkshire Regional Planning Commission, an MVP Provider, to aid them in developing the updated Hazard Mitigation Plan and the MVP Plan. The overarching goal of the Committee was to develop a set of actions for addressing Priority Hazards, using the Community Resilience Building (CRB) workshop process and methodology as a key stakeholder tool. Approval of the plan by EOEEA will enable the town to become eligible to apply for funding to implement the various preparedness measures identified through the CRB process.

<sup>&</sup>lt;sup>1</sup> 2020 United States Census

<sup>&</sup>lt;sup>2</sup> 2020 American Community Survey (ACS) 5-Year Estimates Data Profiles accessed on May 17, 2022 from <a href="https://data.census.gov/cedsci/profile?g=0600000US2500343300">https://data.census.gov/cedsci/profile?g=0600000US2500343300</a>

<sup>&</sup>lt;sup>3</sup> Massachusetts Geographic Information System (MassGIS), 2016.

The Committee held a series of meetings to assemble data on the town's infrastructure, identify known hazards to residents, including seasonal visitors, and review existing plans, procedures, bylaws, and protections already in place. Over the course of a month, from mid-March to mid-April, three twohour virtual CRB workshops took place. Each was attended by a combination of town officials, residents, and other stakeholders. These CRB workshops took place on March 16<sup>th</sup>, March 23<sup>rd</sup>, and April 5<sup>th</sup> and were held via Zoom gathering a total of 28 attendees (See Table 1). Each workshop centered on a different theme - infrastructure, environment, and social/community.

Table 1: Workshop Attendee List

Name	Affiliation
	Facilitators
Courteny Morehouse	Berkshire Regional Planning Commission - Project Coordinator
Lauren Gaherty	Berkshire Regional Planning Commission
Justin Gilmore	Berkshire Regional Planning Commission
Emily Lange	Berkshire Regional Planning Commission
Carrieanne Petrick	MVP Regional Coordinator for Berkshires and Hilltowns
	HM/MVP Core Team
Jim Lovejoy	Mt. Washington Select Board
Ellie Lovejoy	Mt. Washington Board of Health and former EMD
Nancy Wright	Mt. Washington Former Planning Board Member
Mack Waggaman	Mt. Washington Conservation Commission, Invasives Committee
Judy Isacoff	Mt. Washington Resident and owner of Nature's Turn
	Workshop Attendees
Eric Mendelsohn	Mt. Washington Select Board
Brian Tobin	Mt. Washington Selectboard, EMD, Acting Chief of Police
Corey Hines	Mt. Washington Council on Aging
Elisabeth Lem	Mt. Washington Office Manager
Rod Parlee	Appalachian Mountain Club
Doug Brown	Berkshire Natural Resources Council
Jessica Speer-Holmes	Camp Hi-Rock
Chris Ricard	Copake Taconic State Park, Bash Bish Falls
Elia Del Molino	Greenagers
Angela Sirois-Pitel	The Nature Conservancy
Rene Wendell	The Nature Conservancy
Andy Traines	Mt. Washington Resident
Hans Bergmann	Mt. Washington Resident
Harriet Bergmann	Mt. Washington Resident
Judy Whitbeck	Mt. Washington Resident
Marc Spiegel	Mt. Washington Resident
Tom Furcht	Mt. Washington Resident
Vanessa Gang	Mt. Washington Resident
Liz Nash	Mt. Washington Seasonal Resident
Reuel Nash	Mt. Washington Seasonal Resident
Tom Clapp	Mt. Washington New Resident

The central objective of the workshops was to first review regional weather events from the past and climate change data and projections, then collect local data from attendees, and create a climate-related Natural Hazard Risk Matrix for the town, including a written Summary Report that:

- 1. Defined top local natural and climate-related hazards and concerns.
- 2. Identified existing and future strengths and vulnerabilities.
- 3. Developed prioritized actions for the community.
- 4. Identified immediate opportunities to collaboratively advance actions to increase resilience.

Workshop results were reviewed by the Core Team, compiled, and presented in an hour-long Listening Session open to the public. Public Listening Session outreach included flyers handed out at the transfer station, posting to Town website and an email to the list gathered throughout the process.

#### Methods and Materials

In order to identify vulnerable infrastructure and assets, features within the town were categorized by Infrastructural, Societal, and Environmental. The infrastructure category includes municipal infrastructure, housing, utilities, commercial buildings, municipal buildings, and operations. Societal represents the town's collective ability to respond to disruptions including the ability to dispatch first responders, provide health services, and maintain the flow of other goods and services. Environmental includes the natural systems that protect, provide services, or pose risk.

Once the community features were identified along with the location, ownership, and whether that feature is a strength (S) or vulnerability (V), workshop participants began developing initial methods and solutions (actions) to improve resilience. These methods and solutions were then prioritized as high (H), medium (M), and low (L) and a time horizon for completion was estimated as short (S), long (L), or ongoing (O).

Top priorities were chosen in a multi-tier selection process. First, the top two priority actions were selected in small groups at each CRB workshop. Those actions were presented at the end of each session to the large group and another round of voting via a Zoom poll whittled down priority actions to two per session. The Core Team reviewed those chosen six priorities and combined top actions into three possible projects that were then presented at the Public Listening Session for greater public input. The public listening session included a background presentation on climate change data and the planning process, the results of the workshop, and a final polling to select a top action project.

## **Findings**

#### Top Hazards

The top hazards identified by workshop participants as posing the greatest risk to Mt. Washington include flooding, winter storms, wind events, and wildfires. Flooding concerns include extreme precipitation, increased sedimentation due to runoff, and the degradation of local roadways, especially dirt roads, due to undersized culverts and outdated drainage systems. Winter storms encompass ice storms, snowstorms, and severe winter storms. The other two hazards, wildfires and wind events are more general, yet expose vulnerabilities the town will need to address. While not a hazard, it should be noted

that the threat of invasive species to infrastructure, ecological habitat and property values was a common thread during the workshop series.

#### Specific Categories of Challenges and Concerns

#### Roadways

As mentioned, Mount Washington is secluded. It has only three roads that lead out of town and only one, East Street, that connects to the rest of Massachusetts through Egremont. The town's roadway network is made up of paved roads, gravel roads, and dirt roads. A common theme that emerged among workshop participants was the desire to address drainage issues along local roadways and particularly, preventing dirt roads from turning to mud roads after rain or after thawing out from being frozen. Developing a comprehensive plan to manage roadways along with establishing a routine protocol for storm drain/catch basin cleaning was identified as an avenue for addressing this topic. Roadways identified as suffering from these issues include Falls Road, southern East Street, West Street, Mountain Road, Garrett Farms Drive, Club Grounds Road, Salisbury Road, along with long, shared driveways.

#### Culverts

Directly related to roadway degradation and flooding is the topic of culverts. Culverts typically consist of a metal or plastic pipe, with varying dimensions, that allow water (a stream) to flow underneath the roadway from one side to the other. In addition to passing water, culverts can also represent a barrier to or bridge for aquatic organism movement/passage (such as a brook trout headed upstream to spawn).

Of all the regions in the U.S., the Northeast has seen the most dramatic increase in the intensity of rainfall events. The most recent U.S. National Climate Assessment reports that between 1958 and 2010, the Northeast saw more than a 55% increase in the amount of precipitation falling in very heavy events (defined as the heaviest 1% of all daily events). With an increase in the frequency and intensity of precipitation events, the need to upsize culverts to accommodate new water levels and flow rates was identified as an important resiliency strategy. As such, the town has identified the need to develop a plan for replacing undersized culverts that also provide for aquatic organism passage. An element of this plan will also consider developing a protocol where residents can monitor known problem sites and report any issues to the town. Specific locations identified include East Street, Plantain Road, and Old Plantain Pond Road.

#### Sediment Deposition

Also related to roadway degradation and flooding is the topic of sediment transport and deposition. Elevation gains along local roadways, slopes, and the steep hills, common geological features in Mt. Washington, all contribute to sediment transportation and deposition. Exploring avenues for reducing sedimentation runoff and preventing it from entering local waterways was identified as an important action step. Moreover, workshop participants mentioned that residential driveways were a contributing factor to stormwater runoff/sediment transport. Thus, stakeholders suggested exploring an update to local regulations that would address residential driveway drainage, educating homeowners about runoff/sediment issues, and establishing a monitoring and reporting protocol for residents to identify new runoff/sediment issues. According to workshop participants, this issue occurs town-wide and specifically on the southern section of East Street.

#### Internet/Communications

The rural, secluded context of Mt. Washington greatly influences the town's communication systems. In 2017, the town was equipped with fiber optic, taking the town from having no broadband internet at all to having the highest speeds in the county. According to town staff and workshop participants, most residents do not have landline telephones and instead, use their cell phones, connected to the internet through VOIP, to make calls. In the absence of being connected to a network, cell service coverage is spotty and mostly non-existent in most areas of town under most plans. This presents unique challenges while attempting to disseminate important information related to impending hazards and emergency response protocols. To address this issue, participants suggested exploring a satellite dish system to provide emergency communications including a network of satellite phones for residents to use in emergency situations.

Additionally, creating a central communication system for information sharing, such as a sign at Town Hall or other central meeting place residents are aware of, that allows for contribution from residents and communicates what resources exist and where.

#### **Invasive Species**

With 93% of land forested, and 80% of the town's land protected, access to nature is easy. As climate change continues to expand the ecological range of different plants and animals, the town will need to be conscious of the arrival of an increase in invasive species. Invasives such as stiltgrass and barberry are already present in town. According to one workshop participant, specific operations engaged in by the highway maintenance staff could be exacerbating the spread of certain invasives. The town's next step toward resilience includes developing a long-term invasives management plan that involves recruiting and training town staff and volunteers to map and eliminate invasives. The plan will also outline the risks of each invasive to native ecology, will lay the groundwork for collaboration with multiple actors and agencies to manage their spread, and will explore the viability of introducing other species that can provide similar ecosystems services while thriving in a new climate. Additionally, constructing a new highway garage that contains a washing bay for vehicles and personnel to eliminate the spread of invasives was also suggested.

#### Natural Resource Management and Biodiversity

With such a wealth of natural resources, workshop participants stressed the importance of cataloging the type of natural flora and fauna that occupy these spaces. Cataloging species that are present will provide a baseline and allow for tracking how ecosystem dynamics change with the climate. Workshop participants were particularly keen on the need to develop a comprehensive natural resources management plan to maintain and enhance the town's natural assets including old growth forests, vernal pools, and water resources more generally.

#### Visitor Management

Mt. Washington's natural recreational areas draw residents and visitors year-round. At no time was this more true than during the height of the COVID-19 pandemic, particularly during the summer months, when the town saw numerous visitors traveling to Mount Washington State Forest or Bash Bish State Park. Since then, it has become apparent that these places need better management strategies as the high volume of visitors seen during the pandemic resulted in numerous traffic and parking violations which, in some instances blocked emergency vehicle access. Workshop participants identified the need to educate residents and visitors to these natural spaces on safety protocols and environmental stewardship

strategies to increase management and oversight of these areas in partnership with state and land trusts who own the bulk of the property. Additionally, more traffic signage to prevent dangerous driving was a suggested intervention.

#### Wildfire

The town considers itself to be at high risk to wildfires due to the type of forests as well as its climate. The Mt. Everett State Reservation, Mt. Washington State Forest, and Van Der Smissen Memorial are areas of particular concern, especially at high elevations. While there have been no reports of wildfires in the town since the Great Taconic Wildfire of 1930 there has been numerous reports of smoldering (MEMA, 2004, town representatives). The town could not obtain local records on fires since 2000 and the state could not provide more recent information.

Given the forested character of Mt. Washington along with its heavily forested neighboring communities, the risk of wildfire is certainly a consideration. The risk of fire being able to become established and spread is greater here since the responding volunteer fire department is in neighboring Egremont or Copake, NY. It can take thirty-minutes to respond to fires here due to the distance firefighters must travel. As such, workshop participants suggested the town develop a fire management plan that addresses fire breaks and culling of specific areas to mitigate wildfire risk. Additionally, participants stressed the need for the town to have the ability to issue fire hazard alerts or Red Flag warnings on the town's website. Lastly, it was also suggested that the town solicit local first responders to volunteer in the Egremont Fire Department which covers Mount Washington.

#### Emergency Management and Preparedness (Isolation)

Due to the sparse development pattern scattered around town, one can easily feel isolated. Ensuring that residents who are physically isolated from other homes or town buildings have all the adequate information needed to respond accordingly to a given hazard is paramount to enhancing resiliency. Mount Washington has an Emergency Preparedness Plan in place. Participants suggested a review of this document for effectiveness and improvement would be beneficial. Moreover, many residents were not aware of an existing Emergency Preparedness Plan indicating that the Town may benefit from outreach and information about plan details.

#### **Emissions**

Naturally, enhancing resilience includes mitigating greenhouse gas emissions that are driving and accelerating change. As more technologies to reduce emissions emerge, and as more towns begin implementing their use, opportunities for decarbonization abound. Workshop participants suggested the town encourage energy efficiency measures in new and existing buildings, potentially through updates to the town's regulations. Additionally, participants felt it would be worthwhile to provide information on energy reduction technologies to educate homeowners of their options and any available financing programs that might help offset costs. Such benefits exist at the State level through the Mass Save program.

#### Town Capacity

During one of the workshops, there was a discussion among participants that touched on how the town might go about attracting skilled laborers and workers to either volunteer with the town or come and live in Mt. Washington. Workshop participants felt it important for the town to identify the skills that are most needed, such as grant writing, medical expertise, or those experienced with incident command

system management, and then to identify ways of attracting current or prospective residents to assist the town in achieving desired outcomes. Workshop participants also felt it important for the town to place more emphasis on creating regional alliances among different state agencies and conservation organizations. As we have learned by now, enhancing resilience includes actions such as building up relationships and expanding the network of individuals with specialized skills that can assist the town.

#### Current Strengths and Assets

Over the course of the community resilience building workshops, participants identified numerous existing strengths and assets held by the town. They include:

- Yankee spirit of independence and generosity "if a storm hits, we know what to do."
- Small town everyone knows each other and looks out for one another
- Emergency phone system and informal phone tree
- Dirt road study and improvements to dirt roads
- Success in procuring grant funding for various projects
- High-speed internet and good working relationship with internet provider
- Blackboard connect in which most everyone signed up
- 93% forested = carbon storage/sequestration; shaded, cool streams
- Nearly 78% of land is protected open space
- High biodiversity in a small area
- Natural resource attraction for visitors to state parks, open spaces
- Connected landscapes provide movement for species to move northward

#### Top Recommendations to Improve Resilience

Stakeholders participating in Mt. Washington's MVP workshop identified several priority actions under each category that were perceived to be the most important and immediate steps to enhance the town's resilience. Under the infrastructure category, the top prioritized actions seek to address the impacts of flooding on the town's roadways and related culvert upsizing. This would be accomplished though the development of a comprehensive plan that outlines flooding/increased precipitation mitigation strategies for paved and dirt roads, including culvert right-sizing assessments, and improved ditching/drainage.

Under the environmental category, workshop participants identified natural resource management and invasives species management as their top priority actions. Throughout the workshops, numerous participants discussed the importance of protecting the town's endemic flora and fauna from the impacts of invasive species. In addition to mitigating impacts from invasives, the importance of cataloging the town's unique natural resources was also identified. Through developing a comprehensive natural resources plan that addresses invasives, sedimentation, warming waterways, and impact to native biomes, the town will be better positioned to address this topic.

Prioritized actions under the societal category relate to building and strengthening a sense of community among residents through emergency response planning along with enhancing the management of Mt. Washington's recreational areas. Enhancing communal ties and bonds was acknowledged to be an important strategy for disseminating information (such as what to do in the event of an emergency) through semi-formal and informal social interactions. Additionally, during the height of the COVID-19 pandemic, Mt. Washington's natural recreational areas saw a tremendous increase in tourist visitation and activity, particularly at Bash Bish Falls State Park. In order to ensure safety of visitors and protection of these natural assets, the town advocates for increased resources and enforcement by state and land trust partners that manage these areas.

#### Highest Priority

#### Natural Resource Management

- Partner with interested entities to develop comprehensive natural resources management plan that
  includes old growth forest inventory, assessing regulations, strengthening collaboration and
  partnerships, identification of methods for maintaining biodiversity, and educating
  residents/visitors on the importance of forest/water resources (drinking water that Mt. Washington
  supplies to surrounding areas) and best management practices for reducing impacts to these
  important resources.
- Explore installing groundwater monitoring wells to determine current levels and changes over time.

#### Stormwater Management

- Develop plan for replacing culverts (undersized, made of metal, old, failing) that addresses environmental impacts (flooding) of rightsizing along with developing a maintenance plan for existing culverts. Consider incorporating protocol where residents monitor known problem areas (ensure those areas are checked after storms) and report changes/problems to the Town.
- Educate homeowners on runoff/sediment issues and establish monitoring and reporting protocol for residents that notice new runoff/sediment issues.
- Consider update to zoning regulations for residential driveway drainage to redirect runoff away from wetlands.
- Research training opportunities for Conservation Commission and Town Highway to receive additional training with grant support.

#### Roadways

- Develop comprehensive plan to manage roads, especially dirt roads, that incorporate efforts to improve ditching and drainage, mitigate runoff and sedimentation, improve/look at alternatives for retaining walls, and formalizes protocol for regular cleaning of catch basins. Plan should explore access to external funding sources and what other towns have done to mitigate the effects of water on dirt roads (turning the roads to mud) along with other best management practices.
- Comprehensive management plan can also incorporate an exploration of technological/material solutions that would make roads less vulnerable to freeze/thaw cycles.
- Comprehensive management plan should address vehicle weight limits (increase signage, etc.), and reconstruct/rebuild roads near streams.
- Continue to ensure evacuation route is maintained.
- Continue to maintain open lines of communication with neighboring Towns as per Mt. Washington's Emergency Management Plan.

#### Wildfires

 Develop emergency action/fire management plan that addresses protecting public areas, fire breaks, culling/removing fire fuel (including addressing overgrown Christmas trees), acquiring technical assistance to implement and issue fire hazard alert levels on town website, guiding homeowners on how to protect homes, updated fire management tools and methods, and clarifies fire management practices on state properties. Conduct tabletop exercise.

- Town sponsor/host a talk/speaker series on this topic to better inform residents on how we can assess and plan for this hazard.
- Encourage residents to volunteer for emergency response services and fire department that serves Mt. Washington.

#### **Invasive Species**

- Develop long-term invasives management plan that includes recruiting volunteers, training residents and highway personnel/road crew to map and eliminate invasives, identify particular risks of each invasive to native ecology, collaborating with private property, neighboring states, and towns to manage spread, assessing other species (tree species, etc.) that can provide similar ecosystem services while thriving in the 'new climate,' assessing bio-controls, disseminating educational/outreach materials related to invasives, emerging pests and pathogens, and maintaining good forest health.
- Explore and seek funding building a new highway garage with a washing bay. Ensure new facility has enough room for emergency supplies and equipment.

#### Biodiversity Loss Town Wide

- Encourage landowners and volunteers to identify habitats that need protection (ex: State Vernal Pool Certification and bird census), including assessing which habitats may be ecological hotspots in the next 5-10 years based on climate projections.
- Encourage developing a baseline stream temperature (monitors) in ecologically important areas.

#### Loss of Coldwater Habitat and Therefore Brook Trout Population

• Educating municipal and private property owners about the benefits of buffer plantings and stream restoration along all streams in town.

#### Visitor Management

- Encourage DER and other public lands owners to manage and enforce rules regarding public use of water areas (i.e., swimming).
- Encourage state and other public landowners to educate residents and visitors on safety protocols and environmental stewardship and increase management/oversight of public places.
- Encourage collaboration with public landowners to increase staffing and management to accommodate increased traffic, visitor use, safety, and park management.
- Increase advocacy, communication, and collaboration with stakeholders and other towns that have similar issues.

#### Moderate Priority

#### Wetlands

- Develop plan to educate private property owners about the importance of preserving and keeping our wetlands intact, including their ability to slow flooding and study areas of opportunities for flood absorption along with areas that pose the greatest risk.
- Develop stormwater infrastructure plan that emphasizes green infrastructure and nature-based solutions, update drainage infrastructure where necessary.

#### **Emergency Management**

- Continue communication & resource sharing between neighboring towns.
- Promote emergency preparedness through outreach information to new and existing residents.
- Review Emergency Action Plan to identify locations for residents that require air lifting to hospital.
- Educate live-in caregivers on how to handle emergency situations in Mt. Washington.
- Ensure evacuation route is maintained.

#### Isolation and Emergency Preparedness

• Educate live-in caregivers how to handle emergency situations in Mt. Washington.

#### Community Cohesion

- Review and update Emergency Preparedness Plan and conduct outreach to residents.
- Encourage the organization of events designed to bring people together and build sense of community.
- Continue to publicize what volunteer positions are open/needed in town.

#### Internet/Communications

- Continue to manage tree trimming and removal in Town right-of-way where internet, phone, electrical wires are located.
- Explore increased redundancy of internet and phone system including satellite dish system to provide emergency communications if internet goes down.
- Continue and enhance local phone tree for emergency situations.
- Outreach to residents what on what emergency resources currently exist.

#### Low Priority

#### **Town Capacity**

- Identify what is most needed in town and skills associated with needs; hire new staff to help where needed (ex. identifying grant programs, grant writing, soliciting more volunteers, etc.) and solicit residents for skills that may be helpful (ex. medical background, first response, incident command system).
- Strengthen existing regional alliances to share resources and create working relationships.

#### **Emissions**

- Encourage new buildings to be more sustainable (use less fuel) and self-sufficient.
- Explore grants and programs that help town with energy reduction technologies to help municipal buildings.

#### **Power Outages**

Gradually bury power lines and broadband cable where possible.

#### **Dams**

- Encourage maintenance of dams throughout town.
- Work with private property owners to address maintenance concerns on dams that impact town infrastructure and public property. Explore what funding sources can be used to address private dams.

#### Beavers

• Provide outreach materials on how to manage beavers.

#### Community Resilience Building Risk Matrix

Environmental



#### www.CommunityResilienceBuilding.org

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.) H-M-L priority for action over the Short or Long term (and Ongoing) Priority Time V = Vulnerability S = Strength Floods Winter Storms Wind Events Wildfire Short Long **O**ngoing Location Ownership V or S Features Infrastructural Develop plan to educate private property owners about the importance of preserving and keeping our wetlands intact, including their ability to slow flooding and study areas of opportunities for flood absorption along with areas that pose the greatest risk. Wetlands East St. Town/ private Develop stormwater infrastructure plan that emphasizes green infrastructure and nature-based solutions, update drainage infratructure where necessary Encourage maintenance of dams throughout town Work with private property owners to address Various 0 maintenance concerns on dams that impact town infrastructure and public property. Explore what funding sources can be used to address private dams. Throughout Town Beavers S/V Provide outreach materials on how to manage beavers. 0 residences along East St. East St. & Plaintain Rd./Old Develop plan for replacing culverts (undersized, made of metal, old, failing) that addresses environmental Plaintain Pond Culverts impacts (flooding, aquatic organism passability) and 500-520 East St maintenance of existing culverts. on east side runoff goes into stream Falls Road retaining walls; West St.; Comprehensive management plan can also incorporate and explore technologies/material Develop comprehensive plan to manage roads, Mountain Rd.; especially dirt roads, that incorporate efforts to solutions that would make roads less vulnerable to freeze/thaw cycles. Garret Farms improve ditching and drainage, mitigate runoff and Dr. - flash Comprehensive management plan should address vehicle weight limits (increase signage, sedimentation, improve/look at alternatives for flooding; retaining walls, and formalizes protocol for regular etc.), and reconstruct/rebuild roads near streams. Roadways Clubs Ground own/Private 0 cleaning of catch basins. Plan should explore access to Rd. - 6 homes external funding sources and what other towns have Continue to ensure evacuation route is maintained. Long driveway: done to mitigate the effects of water on dirt roads that are shared; (turning the roads to mud) along with other best Continue to maintain open lines of communication with neighboring Towns as per Mt. East St/ management practices. Washington's Emergency Management Plan. Salisbury Rd winter mud & drainage Continue to manage trees near right-of-ways where internet, phone, electrical wires are located. Individuals Explore increased redundancy of internet and phone system - including satellite dish system to provide emergency communications if internet Internet/Communications S/V Townwide Town-owned S/L system Continue and enhance local phone tree for emergency situations. Power Outages Bury power lines and broadband cable S/V L Townwide Town/residents

Invasive Species .	Town Garage; Town-owned Roads; Forested areas; Road edge; Wihitbeck Ln.; Private Homes	Town, private, and State/Protected land	v	Develop long-term invasives management plan that includes re- cach invasive to native ecology, collaborating with private prop- rervices while thriving in the 'new climate,' assessing bio-contro- tealth.  Explore and seek funding building a new highway garage with a	perty, neighboring states, and towns to mana rols, disseminating educational/outreach ma	ge spread, assessing other species (tree sp terials related to invasives, emerging pests	ecies, etc.) that can provide similar ecosystem and pathogens, and maintaining good forest	Н	L/O		
Biodiversity Loss Townwide	Townwide	Town/Private	V/S	he next 5-10 years based onclimate projections.	ourage landowners and volunteers to identify habitats that need protection (ex: State Vernal Pool Certification and bird census), including assessing which habitats may be ecological hotspots in next 5-10 years based onclimate projections.  ourage developing a baseline stream temperature (monitors) in ecologically important areas.						
Loss of coldwater habitat and therefore brook trout population	Coldwater streams through town	Land trusts	V	Educating municipal and private property owners about the benefits of buffer plantings and stream estoration along all streams in town.				Н	0		
Natural Resources Management	Townwide Ridgelines, Mt Darby	Public, Town, neighboring towns, TNC, BNRC, DCR	V/S	partnerships, identification of methods for maintaining biodiver surrounding areas) and best management practices for reducing	there with interested entities to develop comprehensive natural resources management plan that includes old growth forest inventory, assessing regulations, strengthening collaboration and the interesting interesting in the importance of forest/water resources (drinking water that Mt. Washington supplies to counding areas) and best management practices for reducing impacts to these important resources.  **Journal of the importance of forest/water resources (drinking water that Mt. Washington supplies to counding areas) and best management practices for reducing impacts to these important resources.  **Journal of the importance of forest/water resources (drinking water that Mt. Washington supplies to counding areas) and best management practices for reducing impacts to these important resources.						
Sediment Deposition	South East St Townwide	Town	v	Educate homeowners on runoff/sediment issues and stablish monitoring and reporting protocol for residents that notice new runoff/sediment issues.  Consider update zoning regulations for residential triveway drainage to redesign/redirect runoff away rom wetlands.  Research grant support for training opportunities for Conservation Commission and DPW.				Н	0		
Visitors	Jug End, Gilder Pond	DCR, TNC	v	Encourage DER and other public lands owners to manage and er Encourage state and other public land owners to educate reside			agement/oversight of public places.	Н	L/0		
Social				•				,			
Wildfire	Townwide East Street Lee Pond Brook Reservoir	Van Der Smissen Memorial, DCR, Private and Town Property	V				Develop emergency action/fire management plan that addresses protecting public areas, fire breaks, culling/removing fire fuel (including addressing overgrown Christmas trees), acquiring technical assistance to implement and issue fire hazard alert levels on town website, guiding homeowners on how to protect homes, quidated fire management tools and methods, and clarifies fire management practices on state properties. Conduct table top exercise.  Town sponsor/host a talk/speaker series on this topic to better inform residents on how we can assess and plan for this hazard.  Encourage residents to volunteer for emergency response services and fire department that serves Mt. Washington.	Н	S		
Emergency Management	Town-wide	Town & private	V	Continue communication/sharing resources between neighbori butreach and education on emergency preparedness keview and update emergency management plan.	ing towns.			М	S/0		
Communications	Town-wide	Town & private	V	Outreach to residents what on what emergency resources curre	rently exist.			Н	s		

Community Cohesiveness	Townwide	Town	S/V	Encourage the organization of events designed to bring people together and build sense of community  Continue to publicize what volunteer positions are needed in town.	М	S/L
Isolation and Emergency Preparedness	Town-wide	Town & private	V	Educate live-in caregivers how to handle emergency situations in Mt. Washington.	М	S
Visitors	Jug End, Gilder Pond	DCR	V	Encourage collaboration with public land owners to increase staffing and management to accommodate increased traffic, visitor use, safety, and park management.  Increase advocacy, communication, and collaboration with stakeholders and other towns that have similar issues.	Н	L
Emissions	Townwide	Town	V	Encourage new buildings to be more sustainable (use less fuel) and self-sufficient.  Explore grants and programs that help town with energy reduction technologies to help municipal buildings.	L	O
Town Capacity	Town gov't	Town	v	Identify what is most needed in town and skills associated with needs; hire new staff to help where needed (e.g. identifying grant programs, grant writing, soliciting more volunteers, etc.) and solicit residents for skills that may be helpful (ex: medical background, first response, incident command system).	L	S/0

Emergency Action Plan

Update and Correct the Emergency Management Plan